NAVIEN Condensing Boiler

Service Manual

Getting Service

If your boiler requires service, you have several options for getting service:

- Contact Technical Support at 1-800-519-8794 or on the website: www.navienamerica.com.
  For warranty service, always contact Technical Support first..
- Contact the technician or professional who installed your boiler.
- Contact a licensed professional for the affected system (for example, a plumber or electrician).

When you contact Technical Support, please have the following information at hand:

- Model number
- Serial number
- Date purchased
- Installation location and type
- Error code, if any appears on the front panel display.

Version: 1.0(October. 27. 2013)

KD NAVIEN **Navien America, Inc.**
20 Goodyear Irvine, CA 92618 TEL +949-420-0420 FAX +949-420-0430 www.navienamerica.com

NAVIEN Condensing Boiler

Service Manual

Model

NCB-180/ 210/ 240

Keep this manual near this boiler for future reference whenever maintenance or service is required.

*** The wetted surface of this product contacted by consumable water contains less than one quarter of one percent(0.25%) of lead by weight.**

WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death.

- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**
- **WHAT TO DO IF YOU SMELL GAS**
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**
- **The installation must conform with local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.**
- **When applicable, the installation must conform with the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 and/or CAN/CSA Z240 MH Series, Mobile Homes.**

KD NAVIEN

Revisions

Version	Description of changes	Date
1.00	First Issue	October/27/2013

1.00 Reviewed BY:

Contents

1. Safety Information 8

1.1 Safety Definitions 8
1.2 Safety Symbols 8
1.3 Symbols Used in the Instructions 8
1.4 Safety Precautions 8

2. Product Information 12

2.1 Product Information 12
2.2 Components 14

3. Technical Data 16

3.1 General Specifications 16
3.2 Dimensions 18

4. System Details 19

4.1 Setting the DIP Switches 19
4.1.1 Setting the DIP Switches 19
4.2 Measuring the Inlet Gas Pressure 23
4.2.1 Gas Pipe Sizing Tables (Referenced from 2012 National Fuel Gas Code) 24
4.3 Gas Conversion 26
4.4 The Front Panel 32
4.4.1 LCD Display 32
4.4.2 Buttons 33
4.4.3 Turning the Boiler On or Off 35
4.4.4 Normal Operation 35
4.4.5 Error Display and RESET 37
4.4.6 Adjusting the Space Heating Temperature 37
4.4.7 Adjusting the DHW Temperature 38
4.4.8 Viewing Basic Information (For Homeowner) 39
4.4.9 Error occurrence history display 41
4.4.10 information display (for servicer) 42
4.4.11 Special Parameter mode 46
4.4.12 Resetting the Boiler (Factory Reset) 55
4.5 Version Display 55
4.6 Error Codes 55
4.7 Ladder Diagram 56
4.8 Electrical Diagnostic Point & Wiring Diagram 57
4.9 Key Components Description 60
4.9.1 PCB 60
4.9.2 High Limit Switch 61
4.9.3 Thermistor 62
4.9.4 Fan Motor 63
4.9.5 Flame Rod Assembly 64
4.9.6 Ignition Transformer 65
4.9.7 APS 66
4.9.8 Main Gas Valve 67
4.9.9 Burner 68
4.9.10 Flow Sensor 69
4.9.11 Primary Heat Exchanger 70
4.9.12 Secondary Heat Exchanger 71
4.9.13 DHW Heat Exchanger 72
4.9.14 Circulation Pump 73
4.9.15 3-Way Valve 74
4.9.16 Water Pressure Sensor 75
4.9.17 Auto feeder Valve 76

5. Troubleshooting 77

5.1 Error code classification 77
5.2 Error Code List 78
5.2.1 003Error 80
5.2.2 004Error 86
5.2.3 012Error 87
5.2.4 016Error 90
5.2.5 030Error 92
5.2.6 046Error 94
5.2.7 047Error 94
5.2.8 060Error 95
5.2.9 109Error 97
5.2.10 110Error 99
5.2.11 205Error 100
5.2.12 218Error 102
5.2.13 351Error 104
5.2.14 352Error 106
5.2.15 353Error 107
5.2.16 407Error 108
5.2.17 421Error 110
5.2.18 439Error 112
5.2.19 515Error 114
5.2.20 517Error 115
5.2.21 594Error 115
5.2.22 615Error 115
5.2.23 736Error 116
5.2.24 782Error 117
5.3 Troubleshooting guide by symptom 118
5.3.1 Noise 118
5.3.2 Water Temperature Issue 119
5.3.3 Circuit breaker operation 120

6. Replacement of Parts 121

6.1 Replacement Procedure 121

6.2 Components Replacement Instructions 121

6.2.1 PCB 121

6.2.2 Fuse 122

6.2.3 Fan Motor (Combustion Air) 122

6.2.4 Flame Rod 123

6.2.5 Ignition Transformer 124

6.2.6 APS 124

6.2.7 Main Gas Valve 125

6.2.8 Condensate Trap 126

6.2.9 Flow Sensor 127

6.2.10 Circulation Pump 127

6.2.11 3-way Valve 128

6.2.12 Water Pressure Sensor 129

6.2.13 Space Heating Strainer 129

6.2.14 Auto Feeder Valve 130

6.2.15 DHW Heat exchanger 130

7. Components Diagram and Part List 131

7.1 Case Assembly 131

7.2 Burner Assembly 132

7.3 Waterway Assembly 134

7.4 Fan (Gas) Assembly 136

8. Inspection and Maintenance Schedule 138

8.1 Annual Servicing 138

8.2 Maintenance Report 138

8.3 Maintenance Schedules 138

8.4 Inspection Report 138

Requirements for the State of Massachusetts

This appliance must be installed by a licensed plumber or gas fitter in accordance with the Massachusetts Plumbing and Fuel Gas Code 248 CMR Sections 2.00 and 5.00.

IMPORTANT: In the State of Massachusetts (248 CMR 4.00 & 5.00)

For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. INSTALLATION OF CARBON MONOXIDE DETECTORS. At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors

   a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

   b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

2. APPROVED CARBON MONOXIDE DETECTORS. Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. SIGNAGE. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, “GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS”.

4. INSPECTION. The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

Navien Warranty

Warranty Period

Navien products come with a limited warranty covering labor, parts and the heat exchanger. The following warranty periods begin to run from the date of original installation. The date of original installation must be provided to Navien, and upon request, proof of the original installation date must also be provided to Navien. When the product is installed in a new construction, the commencement date shall be dated upon which the end-user takes title to the property.

Warranty Period

Product	Labor Warranty	Parts Warranty	Heat Exchanger Warranty
NCB Series Boiler (Single Family Residential Use)	1 Year	5 Years	10 Years

Warranty Claim Procedures

To obtain warranty repair service, the end user or homeowner must contact the original installer of your Navien product. If the original installer cannot be identified, the end user or homeowner may contact Navien's Technical Administration Department at **(800) 519-8794**. Proof of purchase is required to obtain warranty service.

Warranty Service

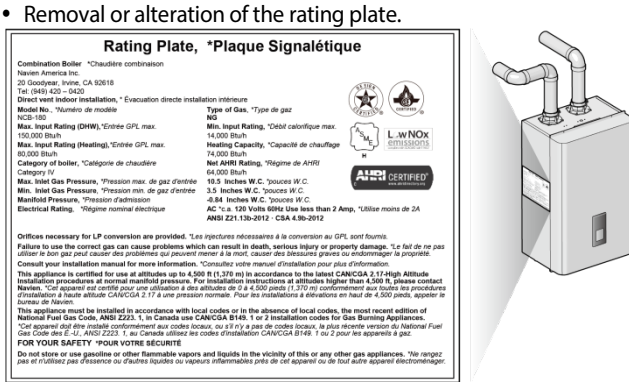
At its option, Navien will replace the defective component (part(s) or heat exchanger), in accordance with the terms of this Limited Warranty, if it fails in normal use and service during the Applicable Warranty Period identified above. The replacement component must be Navien original factory component. Navien, at its sole discretion, may replace the product with a new or refurbished product of comparable quality and design. The replacement component or product will be warranted only for the unexpired portion of the original component's Applicable Warranty Period. Payment for labor in completing the warranty service is subject to Navien's prior written approval and shall be subject to Navien's schedule of approved labor allowances.

Warranty Exclusions

Navien's Limited Warranty shall be void in the event of an occurrence of any of the following:

- Improper installation, failure to install in strict compliance with the Installation Manual procedures, installed by a non-licensed installer, and installation in violation of applicable rules, laws or building codes.
- Product purchased through the internet, other e-commerce channels, or any installer that obtained the Product from a supplier or distributor not authorized by Navien.
- Failure to perform regular maintenance, misuse, operation at settings other than those recommended or specified, non-compliance with instructions or guidelines set forth in the User's Operation Manual.
- Modification or alteration of the Product in any manner, including but not limited to, removal of any component or part, addition of any non-approved components, relocating or moving the Product from its original installation site, or any accidental or intentional damage to the Product.
- Installation in commercial or multi-unit dwelling applications or for non-recommended uses.
- Any damage caused by local adverse conditions including but not limited to hard water deposits, lime or mineral build-up, operating in corrosive atmospheric elements.
- Damage or caused by gas flow issues, electrical surges, flooding, fire, abnormal external temperature, and any other cause of damage not directly caused by a manufacturing defect.
- Installer's failure to fully comply with the Warranty Service and Return Policy procedures previously provided to Installer and as is available on Navien's website. Such policies include but are not limited to the Installer's failure to first contact Navien Technical Support while in front of the product for purposes of trouble shooting the identified problem or issue.
- Performance problems caused by improper sizing of the boiler, the gas supply line, the venting connection, combustion air openings, electric service voltage, wiring, fusing or any other components, parts or specifications.
- Improper conversion from natural gas to LP gas or LP gas to natural gas or attempt to operate with a type of gas not specified for the boiler.
- Any damage, malfunction or failure caused by abuse, negligence, alteration, accident, fire, flood, freezing, wind, lightning and other acts of God.
- Operating, using or storing the boiler in a corrosive or contaminated atmosphere or environment.

- Operating the boiler at water temperatures outside the factory calibrated temperature limits and/or exceeding the maximum setting of the high limit control.
- Operating the boiler when it is not supplied with potable water at all times.
- Subjecting the heat exchanger to pressures or firing rates greater or lesser than those shown on the rating plate.
- Installation at any location outside the United States and Canada.
- Removal or alteration of the rating plate.



Rating Plate, *Plaque Signalétique

Combination Boiler *Chaudière combinaison
Navien America Inc.
20 Goodyear, Irvine, CA 92618
Tel: (949) 420 – 0420
Direct vent indoor installation, * Évacuation directe installation intérieure

Model No., *Numéro de modèle NCB-180	**Type of Gas**, *Type de gaz NG
Max. Input Rating (DHW), *Entrée GPL max. 150,000 Btu/h	**Min. Input Rating,** *Débit calorifique max. 14,000 Btu/h
Max. Input Rating (Heating), *Entrée GPL max. 80,000 Btu/h	**Heating Capacity,** *Capacité de chauffage 74,000 Btu/h
Category of boiler, *Catégorie de chaudière Category IV	**Net AHRI Rating,** *Régime de AHRI 64,000 Btu/h
Max. Inlet Gas Pressure, *Pression max. de gaz d'entrée	**10.5 Inches W.C.** *pouces W.C.
Min. Inlet Gas Pressure, *Pression min. de gaz d'entrée	**3.5 Inches W.C.** *pouces W.C.
Manifold Pressure, *Pression d'admission	**-0.84 Inches W.C.** *pouces W.C.
Electrical Rating, *Régime nominal électrique	**AC** *c.a. **120 Volts 60Hz Use less than 2 Amp,** *Utilise moins de 2A

ANSI Z21.13b-2012 · CSA 4.9b-2012

Orifices necessary for LP conversion are provided. *Les injecteurs nécessaires à la conversion au GPL sont fournis.
Failure to use the correct gas can cause problems which can result in death, serious injury or property damage. *Le fait de ne pas utiliser le bon gaz peut causer des problèmes qui peuvent mener à la mort, causer des blessures graves ou endommager la propriété.
Consult your installation manual for more information. *Consultez votre manuel d'installation pour plus d'information.
This appliance is certified for use at altitudes up to 4,500 ft (1,370 m) in accordance to the latest CAN/CGA 2.17-High Altitude Installation procedures at normal manifold pressure. For installation instructions at altitudes higher than 4,500 ft, please contact Navien. *Cet appareil est certifié pour une utilisation à des altitudes de 0 à 4,500 pieds (1,370 m) conformément aux toutes les procédures d'installation à haute altitude CAN/CGA 2.17 à une pression normale. Pour les installations à élévations en haut de 4,500 pieds, appeler le bureau de Navien.
This appliance must be installed in accordance with local codes or in the absence of local codes, the most recent edition of National Fuel Gas Code, ANSI Z223. 1, in Canada use CAN/CGA B149. 1 or 2 installation codes for Gas Burning Appliances. *Cet appareil doit être installé conformément aux codes locaux, ou s'il n'y a pas de codes locaux, la plus récente version du National Fuel Gas Code des É.-U, ANSI Z223. 1. au Canada utilisez les codes d'installation CAN/CGA B149. 1 ou 2 pour les appareils à gaz.
FOR YOUR SAFETY *POUR VOTRE SÉCURITÉ
Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other gas appliances. *Ne rangez pas et n'utilisez pas d'essence ou d'autres liquides ou vapeurs inflammables près de cet appareil ou de tout autre appareil électroménager.

Other Terms: This Limited Warranty is subject further to the terms and conditions set forth herein and as may be further specified in the Terms and Conditions page located on Navien's website at www.navienamerica.com. WITH THE EXCEPTION OF THIS LIMITED WARRANTY, NAVIEN DISCLAIMS ANY OBLIGATION OR LIABILITY WITH RESPECT TO THE PRODUCTS OR THEIR SALE AND USE, AND NAVIEN NEITHER ASSUMES NOR AUTHORIZES THE ASSUMPTION OF, ANY OBLIGATION OR LIABILITY IN CONNECTION WITH THE PRODUCTS. THIS DISCLAIMER INCLUDES ANY OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY RESPECTING THE PRODUCTS OR ANY PARTS OR COMPONENTS THEREOF, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Navien's total liability for any claim arising hereunder shall not exceed the purchase price which you paid for the Product. NAVIEN SHALL NOT IN ANY EVENT BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL OR LIQUIDATED DAMAGES OR PENALTIES, INCLUDING CLAIMS FOR LOST REVENUE, PROFITS OR BUSINESS OPPORTUNITIES, EVEN IF NAVIEN HAD OR SHOULD HAVE HAD ANY KNOWLEDGE, ACTUAL OR CONSTRUCTIVE, OF THE POSSIBILITY OF SUCH DAMAGES.

Abbreviations and Definitions

Abbreviation	Definition
NCB	General name of NCB-180, NCB-210, and NCB-240
NG	Natural Gas
LP	Propane Gas
AP	Air Pressure
APS	Air Pressure Sensor
DHW	Domestic Hot Water
FM	Fan Motor
GARC	Gas Air Ratio Control
GPM	Gallons Per Minute
MGV	Main Gas Valve
RPM	Revolutions Per Minute
PCB	Printed Circuit Board
EMI	Electromagnetic Interface
HTL	High Temperature Limiter
LWCO	Low Water Cut Off

1. Safety Information

1.1 Safety Definitions

The following safety symbols are used in this manual. Read and follow all safety instructions in this manual precisely to avoid unsafe operating conditions, fire, explosion, property damage, personal injury, or death.

1.2 Safety Symbols

DANGER

Indicates an imminently hazardous situation which, if not avoided, could result in severe injury or death.

WARNING

Indicates a potential hazardous situation which, if not avoided, could result in injury or death.

CAUTION

Indicates an imminent hazardous situation which, if not avoided, may result in minor or moderate injury.

1.3 Symbols Used in the Instructions

IMPORTANT

Warns of a risk of damage and environmental pollution

NOTE

Indicates additional information that is important but not related to personal injury or property damage.

1.4 Safety Precautions

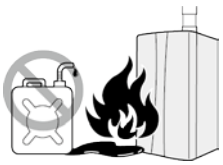
DANGER

FLAMMABLE MATERIALS

Keep the area around the boiler clear and free from flammable materials.

- DO NOT place flammable liquids such as oils or gasoline, etc. near the boiler.
- DO NOT place combustibles such as newspapers and laundry etc. near the boiler or the venting system.
- DO NOT place or use hair spray, spray paint or any other type of spray can near the boiler or the venting system (including the vent termination).
- DO NOT place anything in or around the vent terminations that could obstruct the air flow in and out of the boiler such as a clothes line.

DANGER



FLAMMABLE VAPORS

Vapors from flammable liquids will explode and catch fire causing death or severe burns.

Do not use or store flammable products such as gasoline, solvents or adhesives in the same room or area near the boiler.

- Keep flammable products: far away from the boiler in approved containers, tightly closed, and out of children's reach.
- Boiler has a main burner flame: which can come on at any time, and may ignite flammable vapors.
- Vapors: cannot be seen, are heavier than air, go a long way on the floor and can be carried from other rooms to the main burner flame by air currents.

DANGER

COMPROMISED VENTING SYSTEM

- Failure to follow the Venting Section of the installation manual may result in unsafe operation of this boiler. To avoid the risk of fire, explosion or asphyxiation from carbon monoxide, never operate the boiler unless it is properly vented to the outside and has an adequate air supply for proper operation.
- Be sure to inspect the vent termination and the air intake pipe annually to ensure safe operation of the boiler.
- Immediately turn off and do not use the boiler if any of the vent pipes, vent elbows and/or the boiler are:
  - damaged in any way;
  - separated at a joint,
  - cracked or show evidence of corrosion, rusting or melting.

DANGER

WHAT TO DO IF YOU SMELL GAS

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

DO NOT OPERATE THE BOILER.

DO NOT OPERATE ANY FAUCETS.

Smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

- Do not smoke.
- Extinguish any open flames and sparks.
- Do not operate light switches or electrical equipment switches.
- Do not use any phone in your building.
- Open the windows and doors.
- Close the gas shutoff valve.
- Keep people away from the danger zone.
- Observe the safety regulations of your local gas supplier, found on the gas meter.
- Immediately call your gas supplier from the outside of the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Notify your plumbing/heating contractor from the outside of the building.

DANGER

HOT WATER TEMPERATURE SETTING

- Water temperatures at or above 125°F (52°C) can cause severe burns instantly or death from scalds.
- Households with small children, disabled, or elderly persons may require 120 °F (49°C) or lower temperature setting to prevent contact with "HOT" water.

TO PREVENT BURNS

- Use the lowest operating temperature setting necessary to provide comfortably-hot water.
- If your household has children or elderly or disabled residents, consider using a lower temperature setting.
- Read all the instructions in this manual carefully before changing the temperature setting.
- Feel the water before using it on children, the elderly, or the disabled.
- Contact a licensed plumber or your local plumbing authority for more information.
- This boiler's water temperature is set to 120°F (49°C) at the factory for your safety and comfort. Increasing the temperature increases the risk of accidental scalding. Water temperatures at or above 125°F (52°C) can cause instant scalding, severe burns or death. Before you decide to change the temperature setting, read the following charts carefully.

Water Temperature	Time in which a young child can suffer a full thickness (3rd degree) burn
70 °C (160°F)	Less than 1 second
60 °C (140°F)	1 second
55 °C (130°F)	10 second
49 °C (120°F)	10 minutes
37 °C (110°F)	very low scald risk

DANGER

INSTALLATION REQUIREMENTS

- Installation conditions may affect how the boiler is serviced. Read all related information in the "Installation Manual".
- The Boilers must be installed according to all local and state codes or, in the absence of local and state codes, the most recent edition of the "National Fuel Gas Code (ANSI Z223.1/NFPA 54)" in the USA or the "National Gas and Propane Installation Code (CAN/CSA B 149.1)" in Canada.
- Massachusetts code requires this boiler to be installed in accordance with Massachusetts Plumbing and Fuel Gas Code 248 CMR Section 2.00 and 5.00.

DANGER

IMPORTANT SAFETY PREAUTIONS

- Read and understand this safety information before operating or servicing this Navien Boiler.
- Confirm the location of the gas shut-off valve. Close the manual shut-off valve if the Navien Boiler ever becomes subjected to overheating, fire, flood, physical damage or any other such damaging condition during servicing.
- DO NOT turn on the boiler unless water and gas supplies are fully opened.
- DO NOT turn on the boiler if the cold water supply shut-off valve is closed.
- Make certain power to the boiler is "OFF" before removing the front cover for any reason.
- Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.
- Improper adjustment, alteration, service or maintenance can cause property damage, personal injury, or death.
- To prevent scalding, always check the temperature of the hot water after servicing.
- DO NOT attempt to change the water temperature while someone is using the boiler.
- DO NOT use parts other than those specified for this equipment.
- DO NOT operate the boiler if you feel something is wrong with the unit.
- DO NOT allow children to operate or otherwise handle the unit.

WARNING

GAS TYPE and AC VOLTAGE

This boiler is configured for Natural Gas from the factory. If conversion to Propane Gas is required, the conversion kit supplied with the boiler must be used.

- Be sure to use 120 VAC, 60 Hz, minimum 2 A current. Using abnormally high or low AC voltage may cause abnormal operation, and may reduce the life expectancy of this product.

If the unit does not match requirements, do not service, please contact Navien immediately.

WARNING

GAS CONVERSION

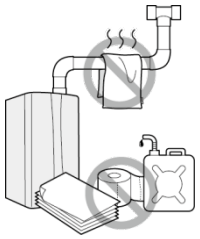
The conversion kit shall be installed by a qualified service agency* in accordance with Navien America's instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instructions supplied with the kit.

*** A qualified service agency is any individual, firm, corporation or company which either in person or through a representative is engaged in and is responsible for the connection, utilization, repair or servicing of gas utilization equipment or accessories; who is experienced in such work, familiar with all precautions required, and has complied with all of the requirements of the authority having jurisdiction.**

In Canada: The conversion shall be carried out in accordance with the requirements of the provincial authorities having jurisdiction and in accordance with the requirements of the CAN-B149.1 and CAN1-B149.2 Installation Code.

Navien America Inc. is not liable for any property damage and/or personal injury resulting from unauthorized conversions.

WARNING



- **Shut off the gas supply if the boiler is damaged.**
  Have your installer or plumber show you the location of the gas shut off valve and demonstrate how to close the valve. If the boiler is damaged as a result of overheating, fire, flood, or any other reason, close the manual shut off valve and do not operate the boiler again until it has been inspected by a qualified technician.
- **Do not store or use gasoline or other flammable liquids near this boiler.**
  Doing so may result in fire or explosion.
- **Do not place combustibles, such as newspapers or laundry, near the boiler or venting system.**
  Doing so may result in a fire.
- **Do not place or use hair sprays, spray paints, or any other compressed gases near the boiler or venting system, including the vent termination.**
  Doing so may result in fire or explosion.
- **Do not operate the boiler with the front cover opened.**
  Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not operate this boiler without proper venting.**
  Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death. Inspect the vent termination and air intake supply annually to ensure proper operation of the boiler. Turn off and discontinue use of the boiler if any of the vent pipes, vent elbows, or intake pipes are damaged in any way, separated at a joint, or show evidence of corrosion, rusting, or melting.
- **Do not touch the power cord or internal components of the boiler with wet hands.**
  Doing so may result in electric shock.

CAUTION

- **Do not attempt to repair or replace any part of the boiler, unless it is specifically recommended in this manual.**
  For all other service, contact an authorized technician or licensed professional. Improper adjustments, alterations, service, or maintenance may lead to property damage, personal injury, or death and will void your warranty.
- **Do not operate the boiler if you feel something is wrong with it.**
  Doing so may result in product damage or personal injury.
- **Do not allow children to operate or access the boiler.**
  Doing so may result in product damage or personal injury.
- **Do not attempt to change the water temperature while the boiler is being used.**
  Doing so may result in personal injury.
- **Do not turn on the boiler unless the water and gas supplies are fully opened.**
  Doing so may damage the boiler.
- **Do not turn on the water if the cold water supply shut-off valve is closed.**
  Doing so may damage the boiler.
- **Do not use this boiler for anything other than its intended purpose, as described in this manual.**
- **Do not remove the front cover unless the power to the boiler is turned off or disconnected.**
  Failure to do so may result in electric shock.
- **When servicing the controls, label all wires prior to disconnecting them.**
  Failure to do so may result in wiring errors, which can lead to improper or dangerous operation.
- **Do not use unapproved replacement or accessory parts.**
  Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.
- **Do not place anything in or around the vent terminals, such as a clothes line, that could obstruct the air flow in or out of the boiler.**

2. Product Information

- **This boiler has been approved for use in the USA and Canada only.**
  Using the boiler in any other country will void the manufacturer's warranty.
- **Should overheating occur or the gas supply fail to shut off, turn off the manual gas valve to the appliance.**
- **Do not use this appliance if any part has been under water.**
  Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

2.1 Product Information

Navien features the NCB Series gas boiler with a built-in Circulation Pump and Air vent. This appliance is fully modulating and provides central heating and domestic hot water. Depending on the heat capacity, each model is divided into three types; 180, 210 and 240.

Model	Maximum Space Heating Input	Maximum DHW INPUT
NCB-180	80,000 Btu/h	150,000 Btu/h
NCB-210	100,000 Btu/h	180,000 Btu/h
NCB-240	120,000 Btu/h	199,900 Btu/h

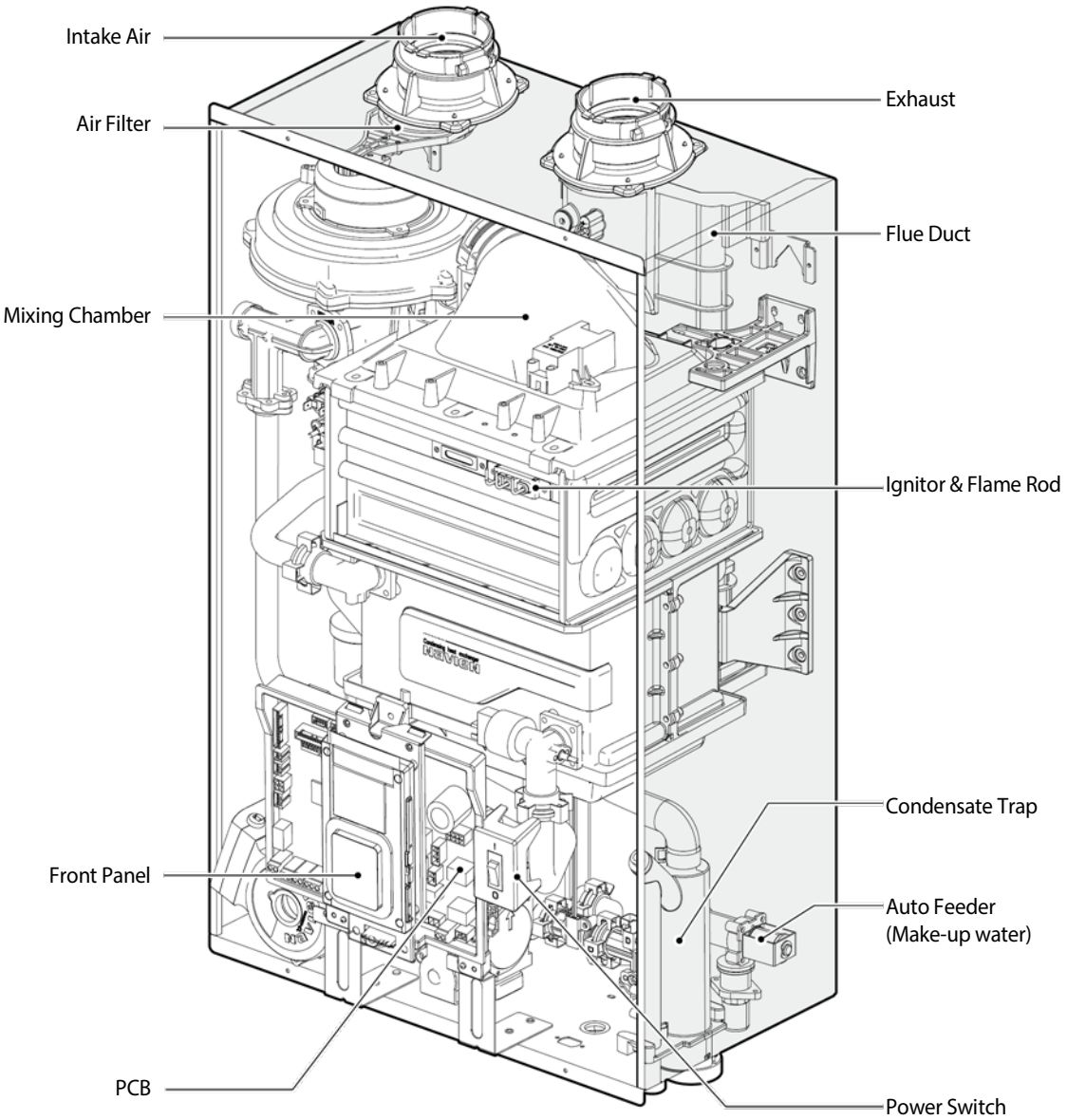
The appliance always gives priority to DHW supply.

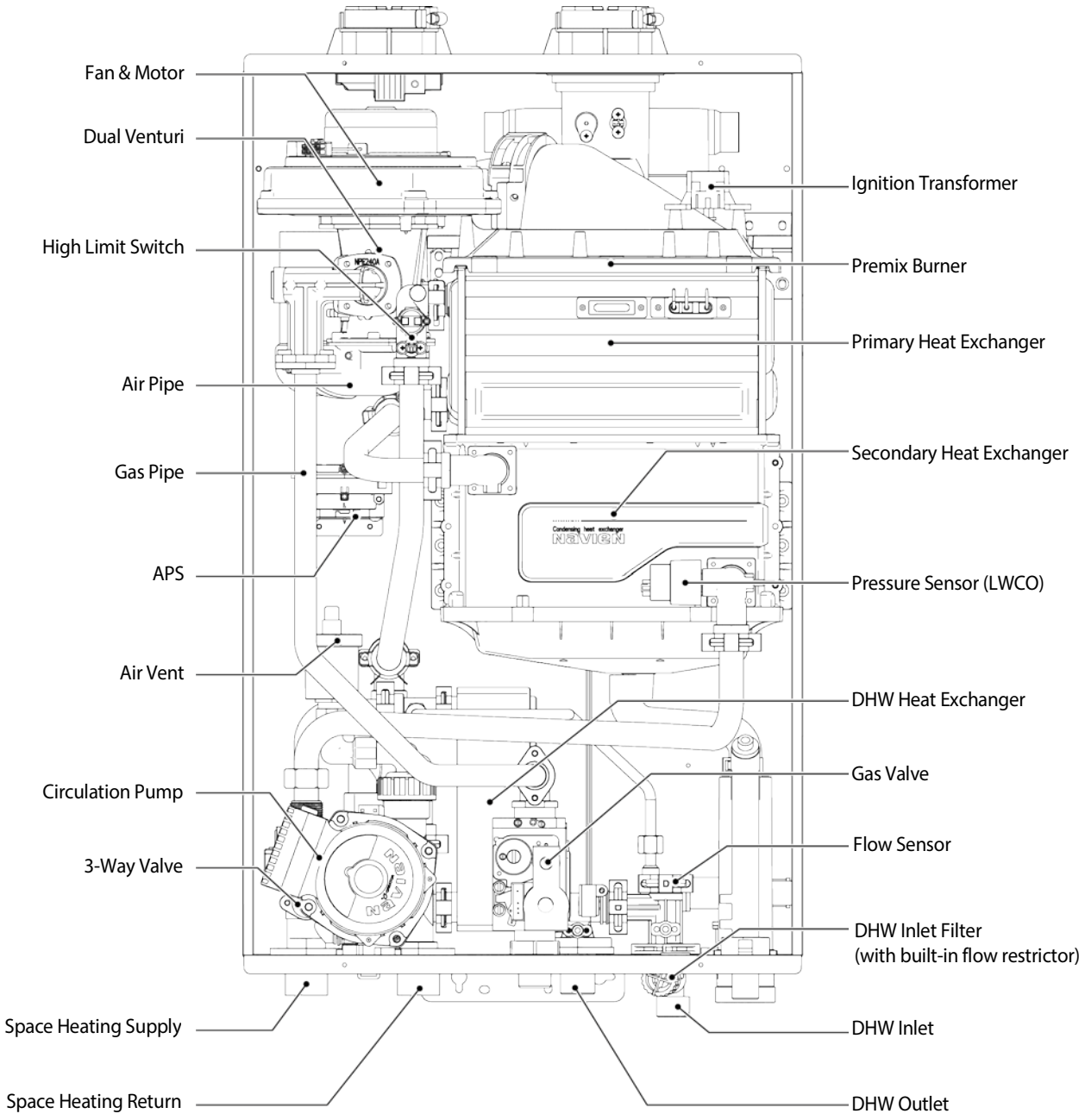
Navien features the NCB Series boiler with a built-in Circulation pump and 3-Way valve assembly, Flow sensor, DHW plate heat exchanger and safety valve(or relief valve). A separate heating expansion vessel is required.

Internal freeze protection and an electronic control unit are incorporated within the boiler. Any standalone room thermostat or set of contacts be used with boiler.

2.2 Components

The following diagram shows the key components of the boiler. Component assembly diagrams and particular parts lists are included in the Appendixes.




Fan & Motor
Dual Venturi
High Limit Switch
Air Pipe
Gas Pipe
APS
Air Vent
Circulation Pump
3-Way Valve
Space Heating Supply
Space Heating Return
Ignition Transformer
Premix Burner
Primary Heat Exchanger
Secondary Heat Exchanger
Pressure Sensor (LWCO)
DHW Heat Exchanger
Gas Valve
Flow Sensor
DHW Inlet Filter
(with built-in flow restrictor)
DHW Inlet
DHW Outlet

3. Technical Data

3.1 General Specifications

The following table lists the specifications for the boiler. Additional specifications about water, gas, electric, and air supplies (venting) appear in the Installation section.

Space Heating Specifications

Navien Combination Boiler Space Heating Ratings					
Model Number[1]	Heating Input, MBH		Heating Capacity[2], MBH	Net AHRI Rating Water[3], MBH	AFUE[2], %
	Min	Max			
NCB-180	14	80	74	64	93.5
NCB-210	18	100	92	80	93.6
NCB-240	18	120	109	95	93.3

1. Ratings are the same for natural gas models converted to propane use.
2. Heating capacity values are based on U.S. Department of Energy (DOE) test procedures.
3. The net AHRI water ratings shown are based on a piping and pickup allowance of 1.15. Consult Navien before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping system, etc.

Domestic Hot Water Specifications

Item		NCB-180	NCB-210	NCB-240
Input Ratings	Min	14,000 BTU/H	18,000 BTU/H	18,000 BTU/H
	Max	150,000 BTU/H	180,000 BTU/H	199,900 BTU/H
Water Pressure		15-150 psi		
Minimum Flow Rate		0.5 GPM (1.9 L/m)		
Flow Rate 77°F (43°C) Temp. Rise		3.4 GPM	4.0 GPM	4.5 GPM
DHW Supply Connection Size		3/4 in NPT		
Cold Water Input Connection Size		3/4 in NPT		

General Specifications

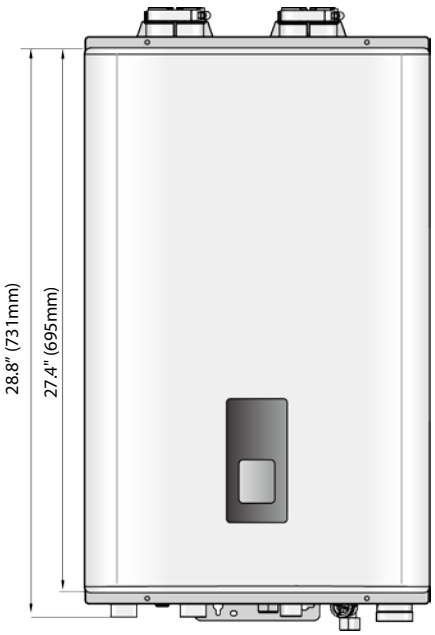
Item		NCB-180	NCB-210	NCB-240
Dimensions		17 in (W) x 28 in (H) x 12 in (D)		
Weight		74 lbs (34 kg)	84 lbs (38 kg)	84 lbs (38 kg)
Installation Type		Indoor Wall-Hung		
Venting Type		Forced Draft Direct Vent		
Ignition		Electronic Ignition		
Natural Gas Supply Pressure (from source)		3.5 in-10.5 in WC		
Propane Gas Supply Pressure (from source)		8.0 in-13.5 in WC		
Natural Gas Manifold Pressure (min/max)		-0.07 in WC / -0.66 in WC	-0.05 in WC / -0.36 in WC	-0.06 in WC / -1.2 in WC
Propane Gas Manifold Pressure (min/max)		-0.06 in WC / -0.62 in WC	-0.1 in WC / -0.66 in WC	-0.03 in WC / -0.98 in WC
Gas Connection Size		3/4 in NPT		
Power Supply	Main Supply	120V AC, 60Hz		
	Maximum Power Consumption	200W (max 2A)		
Materials	Casing	Cold-rolled carbon steel		
	Heat Exchangers	Primary Heat Exchanger: Stainless Steel Secondary Heat Exchanger: Stainless Steel Domestic Water Heat Exchanger: Stainless Steel		
Venting	Exhaust	2 in or 3 in PVC, CPVC, Polypropylene 2 in or 3 in Special Gas Vent Type BH (Class III, A/B/C)		
	Intake	2 in or 3 in PVC, CPVC, Polypropylene 2 in or 3 in Special Gas Vent Type BH (Class III, A/B/C)		
	Vent Clearances	0 in to combustibles		
Safety Devices		Flame Rod, APS, Gas Valve Operation Detector, Ignition Operation Detector, Water Temperature High Limit Switch, Exhaust Temperature High Limit Sensor		
Accessories		Plumb Easy Valve Set, Outdoor Sensor, Pressure Relief Valve, Condensate Neutralizer, Communication Cable		

NOTE

- This unit may be installed at elevations up to 10,100 ft (3,078 m) for use with Natural Gas, and up to 4,500 ft (1,370 m) for use with Propane.

3.2 Dimensions

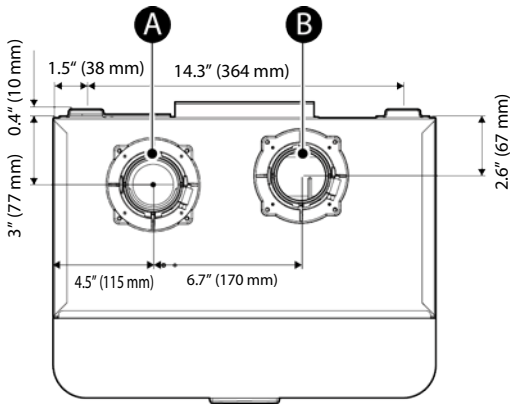
The following diagrams show the dimensions of the boiler and the table lists the supply connections.



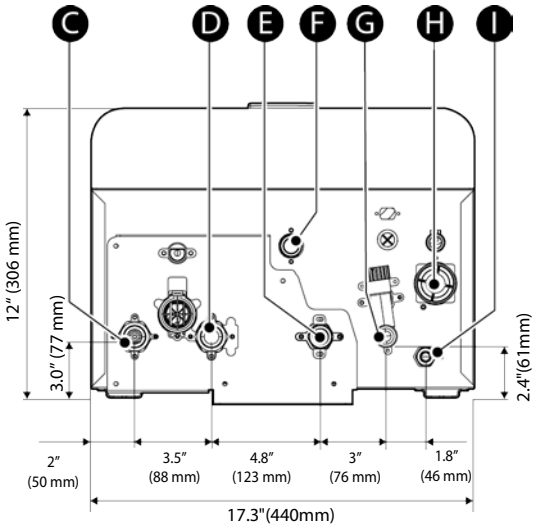
Supply Connections

	Description	Diameter
A	Air Intake	2 in
B	Exhaust Gas Vent	2 in
C	Space Heating Supply	1 in
D	Space Heating Return	1 in
E	Hot Water Outlet (DHW)	3/4 in
F	Gas Supply Inlet	3/4 in
G	Cold Water Inlet (DHW)	3/4 in
H	Condensate Outlet	1/2 in
I	Auto Feeder Inlet (Make-up Water)	1/2 in

Overhead View



Supply Connections



4. System Details

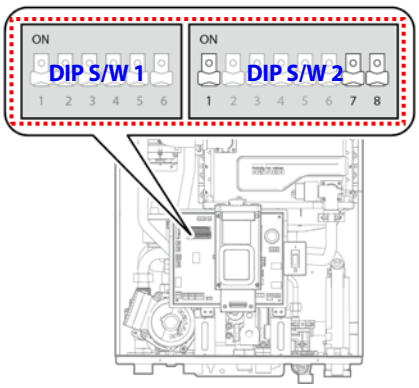
4.1 Setting the DIP Switches

> **CAUTION**
>
> **Do not remove the front cover unless the power to the boiler is turned off or disconnected.** Failure to do so may result in electric shock.

The boiler has two DIP switch locations: on the main circuit board (PCB) and on the front panel. Each location has two sets of DIP switches that control the functionality of the boiler. Set the DIP switches appropriately, based on the installation environment and the gas type.

4.1.1 Setting the DIP Switches

Circuit Board DIP Switches



- Set of DIP Switches 1 (Set of 6)

The DIP switches 1 on the circuit board configure the boiler's model and gas type settings. These configurations are set at the factory and should not be changed. The following tables describe the functions of the DIP switches and their settings.

Switch	Function	Setting	
1 & 2	Operation Mode	Normal	1-OFF, 2-OFF
		Forced Max (2 stage)	1-ON, 2-OFF
		Forced Min (1 stage)	1-OFF, 2-ON
		1 Stage Max	1-ON, 2-ON
3	Reserved	-	-
4	Reserved	-	-
5 & 6	Capacity select	NCB-180	4-OFF, 5-OFF
		NCB-210	4-ON, 5-OFF
		NCB-240	4-OFF, 5-ON
		Abnormal setting	4-ON, 5-ON

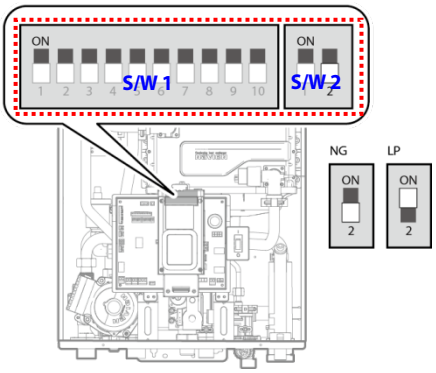
- Set of DIP Switches 2 (Set of 8)

The DIP SW 2 on the circuit board configures additional features at the time of installation, such as temperature control modes.

Switch	Function	Setting	
1	Temperature Control	Return Water	1-ON
		Supply Water	1-OFF
2	Reserved	-	-
3	Reserved	-	-
4	Reserved	-	-
5 & 6	Country select	USA & Canada	5-OFF, 6-OFF
		Reserved	5-OFF, 6-ON
		Reserved	5-ON, 6-OFF
		Reserved	5-ON, 6-ON
7	Thermostat	Permanent CH demand	7-ON
		used	7-OFF
8	Exhaust Thermostat	Temperature Limit Unused	8-ON
		Setting	8-OFF

Setting the Front Panel DIP Switches

Before change the settings, lift the rubber cover to access the front panel DIP switches.



- Set of DIP Switches 1 (Set of 10)

  The DIP SW 1 on the front panel configures the temperature ufnit, well pump, and high altitude settings.

SW1 NO.	Application	Setting		Remarks
1	Reserve			
2	Temperature Unit	℃ (Celsius)	2-ON	
		˚F (Fahrenheit)	2-OFF	
3	Well Pump	Well Pump ON	3-ON	**Well Pump Mode** These settings are to be used with well system when an external pump is wired to the boiler.
		Well Pump OFF	3-OFF	
4 & 5	High Altitude	0-1,999 ft (0-609 m)	4-OFF, 5-OFF	**High Altitude** Above 2,000 ft (610 m), the boiler will de-rate by 4% for each 1,000 ft (305 m) of altitude gain. This boiler may be installed at elevations up to 10,100 ft (3,078 m) for use with Natural Gas and 4,500 ft (1,370 m) for use with Propane. To use the boiler at a specific altitude, the DIP switches should be set as described above.
		2,000-5,399 ft (610-1,645 m)	4-ON, 5-OFF	
		5,400-7,699 ft (1,646-2,346 m)	4-OFF, 5-ON	
		7,700-10,100 ft (2,347-3,078 m)	4-ON, 5-ON	
6	Reserve			
7	Reserve			
8	Reserve			
9	Reserve			
10	Reserve			

- Set of DIP Switches 2 (Set of 2)

  The DIP SW 2 on the front panel configures the gas type setting.

SW1 NO.	Application	Setting		Remarks
1	Reserve			
2	Gas type	Natural Gas	2-OFF	
		Propane Gas	2-ON	

4.2 Measuring the Inlet Gas Pressure

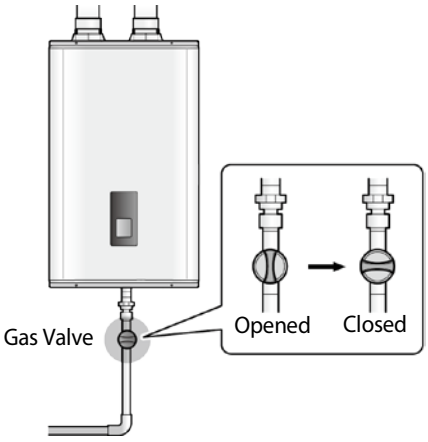
WARNING

The boiler cannot function properly without sufficient inlet gas pressure. Measuring the inlet gas pressure should be performed by a licensed professional only.

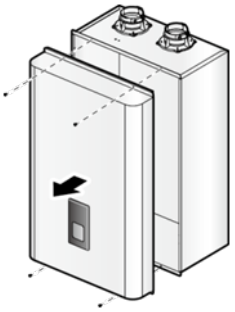
- The inlet gas pressure must be maintained between 3.5″ and 10.5″ WC for natural gas and between 8.0″ and 13.5″ WC for liquefied propane.
- The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.5 kPa).
- The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi (3.5 kPa).

To measure the inlet gas pressure:

1. Shut off the manual gas valve on the gas supply line.



2. Open a hot water faucet. The boiler should turn on and the gas in the gas supply line will be purged.
3. Leave the faucet on until the boiler shuts down due to a lack of gas supply, and then turn off the hot water faucet.
4. Remove the boiler front cover by loosening the 4 Phillips head screws securing it to the case.

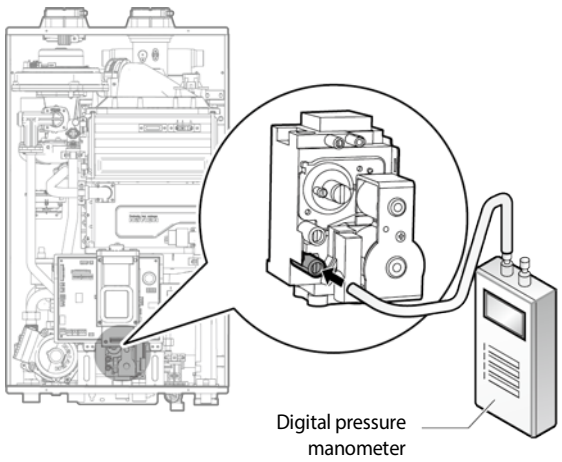


CAUTION

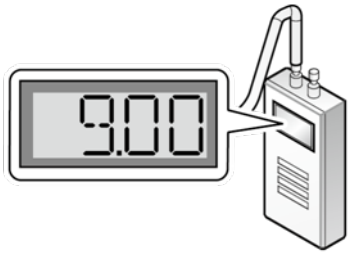
Ensure that no cables are in the way before folding down the PCB assembly. If the assembly is stuck, do not force it. Doing so may damage the cables and result in serious malfunctions.

Check again to ensure that no cables or any other parts are in the way before you proceed.

5. Loosen the screw indicated in the figure below and connect a manometer to the pressure port. Reset the manometer to zero before use.



6. Re-open the manual gas valve and check for leaks.
7. Open multiple fixtures that have high flow rates, such as bathtub and shower faucets, to allow the boiler to operate up to its maximum firing rate.
8. When the boiler reaches its maximum firing rate, check the inlet gas pressure reading on the manometer. The gas pressure must fall within the proper operating range indicated in the previous page and also in the specifications on page 17.



4.2.1 Gas Pipe Sizing Tables (Referenced from 2012 National Fuel Gas Code)

These tables are for reference only. Please consult the gas pipe manufacturer for actual pipe capacities.

Maximum Natural Gas Delivery Capacity

in Cubic Feet (ft^3) per Hour (0.60 Specific Gravity; 0.5" WC Pressure Drop). Contact your gas supplier for BTU/ft^3 ratings. Use 1,000 BTU/ft3 for simplified calculations. This table is recommended for supply pressures less than 6" WC.

Pipe Size	Length (including fittings)										
	10' (3m)	20' (6m)	30' (9m)	40' (12m)	50' (15m)	60' (18m)	70' (21m)	80' (24m)	90' (27m)	100' (30m)	125' (38m)
3/4"	360	247	199	170	151	137	126	117	110	104	92
1"	678	466	374	320	284	257	237	220	207	195	173
1 1/4"	1,390	957	768	657	583	528	486	452	424	400	355
1 1/2"	2,090	1,430	1,150	985	873	791	728	677	635	600	532
2"	4,020	2,760	2,220	1,900	1,680	1,520	1,400	1,300	1,220	1,160	1,020
2 1/2"	6,400	4,400	3,530	3,020	2,680	2,430	2,230	2,080	1,950	1,840	1,630
3"	11,300	7,780	6,250	5,350	4,740	4,290	3,950	3,670	3,450	3,260	2,890
4"	23,100	15,900	12,700	10,900	9,660	8,760	8,050	7,490	7,030	6,640	5,890

in Cubic Feet (ft^3) per Hour (0.60 Specific Gravity; 3.0" WC Pressure Drop). Contact your gas supplier for BTU/ft^3 ratings. Use 1,000 BTU/ft3 for simplified calculations. This table is recommended for supply pressures of 6" WC or greater.

Pipe Size	Length (including fittings)											
	10' (3m)	20' (6m)	30' (9m)	40' (12m)	50' (15m)	60' (18m)	70' (21m)	80' (24m)	90' (27m)	100' (30m)	125' (38m)	
1/2"	454	312	250	214	190	172	158	147	138	131	116	
3/4"	949	652	524	448	397	360	331	308	289	273	242	
1"	1,787	1,228	986	844	748	678	624	580	544	514	456	
1 1/4"	3,669	2,522	2,025	1,733	1,536	1,392	1,280	1,191	1,118	1,056	936	
1 1/2"	5,497	3,778	3,034	2,597	2,302	2,085	1,919	1,785	1,675	1,582	1,402	
2"	10,588	7,277	5,844	5,001	4,433	4,016	3,695	3,437	3,225	3,046	2,700	
2 1/2"	16,875	11,598	9,314	7,971	7,065	6,401	5,889	5,479	5,140	4,856	4,303	
3"	29,832	20,503	16,465	14,092	12,489	11,316	10,411	9,685	9,087	8,584	7,608	
4"	43,678	30,020	24,107	20,632	18,286	16,569	15,243	14,181	13,305	12,568	11,139	

Maximum Liquefied Propane Delivery Capacity

in Thousands of BTU/H (0.5" WC Pressure Drop)

Pipe Size	Length (including fittings)												
	10' (3m)	20' (6m)	30' (9m)	40' (12m)	50' (15m)	60' (18m)	80' (24m)	100' (30m)	125' (38m)	150' (45m)	175' (53m)	200' (60m)	250' (76m)
1/2"	291	200	160	137	122	110	101	94	89	84	74	67	62
3/4"	608	418	336	287	255	231	212	197	185	175	155	140	129
1"	1,150	787	632	541	480	434	400	372	349	330	292	265	243
1 1/4"	2,350	1,620	1,300	1,110	985	892	821	763	716	677	600	543	500
1 1/2"	3,520	2,420	1,940	1,660	1,480	1,340	1,230	1,140	1,070	1,010	899	814	749
2"	6,790	4,660	3,750	3,210	2,840	2,570	2,370	2,200	2,070	1,950	1,730	1,570	1,440

NOTE

- For installations using CSST (flexible) gas piping, please refer to the sizing charts provided by the manufacturer.
- The use of single-stage regulators are recommended. Dual-stage regulators could cause operational issues with the boiler.

4.3 Gas Conversion

NCB Series boilers are configured for use withNatural Gas from the factory. If conversion to Propane Gas is required, the conversion kit supplied with the boiler must be used.

WARNING

This conversion kit shall be installed by a qualified service agency* in accordance with Navien America's instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instructions supplied with the kit.

* A qualified service agency is any individual, firm, corporation or company which either in person or through a representative is engaged in and is responsible for the connection, utilization, repair or servicing of gas utilization equipment or accessories; who is experienced in such work, familiar with all precautions required, and has complied with all of the requirements of the authority having jurisdiction.

In Canada: The conversion shall be carried out in accordance with the requirements of the provincial authorities having jurisdiction and in accordance with the requirements of the CAN-B149.1 and CAN1-B149.2 Installation Code.

Tools Required:

- Phillips Screwdriver
- Flathead Screwdriver
- 5/32" or 4mm Allen Wrench
- Combustion Analyzer or Dual Port Manometer
- Gas Leak Detector

Included Items:

- Gas Orifice (refer to table below)

Boiler	NG		NP	
	1STAGE	2STAGE	1STAGE	2STAGE
NCB-180	Ø4.80	Ø5.95	Ø3.80	Ø4.70
NCB-210	Ø6.10	Ø6.30	Ø4.50	Ø4.80
NCB-240	Ø6.10	Ø6.30	Ø4.50	Ø4.80

Table 1. Orifice size

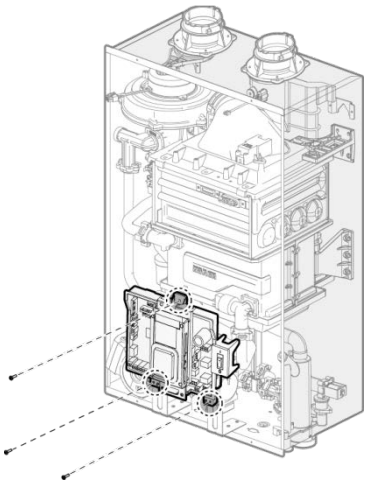
Gas Pressure and Conversion Kit Number Labels

Procedure:

1. Turn off both gas and water supply to the boiler.
2. Using a Phillips hand screwdriver, remove 4 screws (2 from the top and 2 from the bottom) of the front cover assembly to gain access to the internal components. See Figure 1 for illustration of the front cover on the unit.

Figure 1. NCB Series Front cover

3. Once the front cover is removed, place it in a safe location to prevent accidental damage.
4. Label all the wires on the PCB.
5. Disconnect all the wires.
6. Loosen the three screws indicated in the figure 3



7. Remove the PCB assembly.

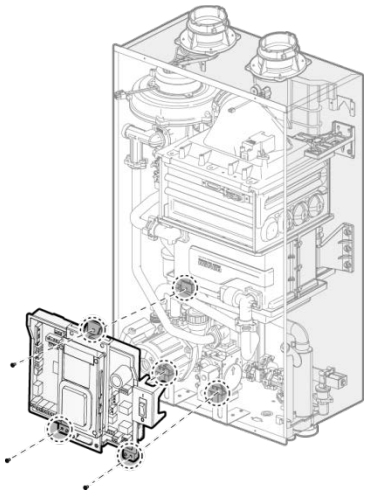
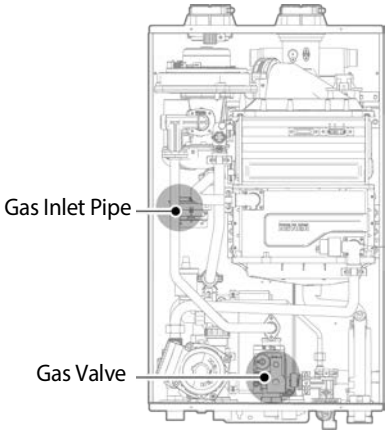


Figure 3. Access to Gas Orifice in Fan Assembly

8. With the internal components exposed, locate the gas inlet pipe and the gas valve in the middle of the unit, as shown below



9. Use a Phillips screwdriver to remove the two screws at location A - the connection below the gas valve where it connects to the pipe. See Figure 4 for reference. Once the screws are removed, carefully separate the pipe from the gas valve.

10. Once the gas inlet pipe is detached from the gas valve, find location B - the connection above the gas valve where it is attached to the fan motor assembly. Carefully remove the four screws by hand using a Phillips screwdriver and pull the gas valve away from the fan assembly to access the gas orifice.

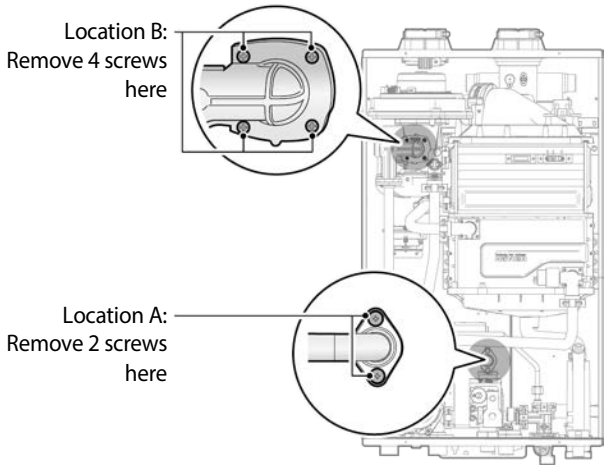
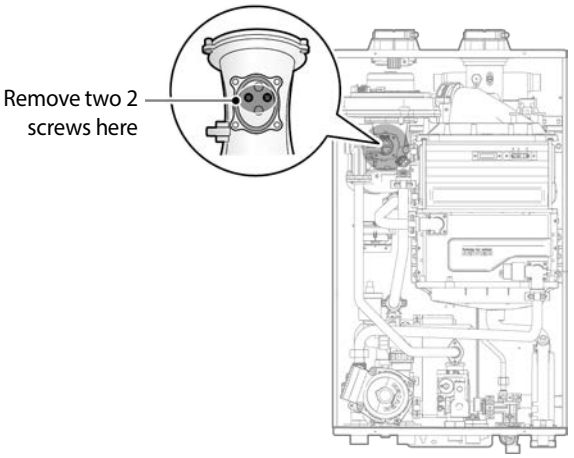


Figure 4. Detaching Gas Valve from
Gas Inlet Pipe and Fan Motor Assembly

11. Once the Gas Orifice is exposed, remove the two screws that hold the part in place. Remove the Gas Orifice from its housing and prepare the new Gas Orifice for the LP conversion for installation.



WARNING

- DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment.
- Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death or substantial property damage. Navien NCB boilers are shipped ready to fire natural gas ONLY.

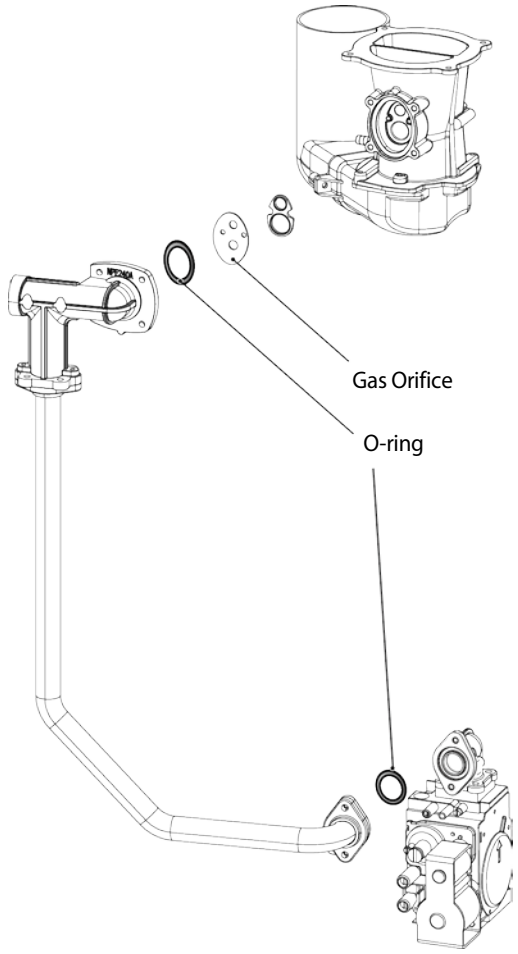


Figure 5. Exploded view of Gas assembly

DANGER

See Figure 5. Inspect the O-ring between the gas valve and gas valve inlet adapter whenever they are disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

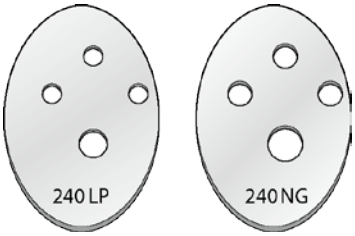


Figure 6. Orifice identification

12. Replace the old Orifice piece with the new part for use with LP gas. Ensure that the Orifice is properly seated inside the port before proceeding to the next step.
13. Replace the gas inlet pipe to its original position and use all screws to secure all connections.

NOTE

Do not overtighten as this may damage or crack the components.

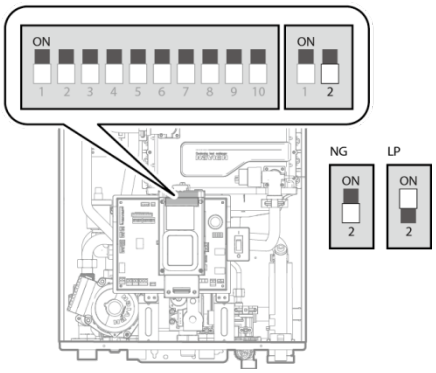
DANGER

Inspect the O-ring between the gas valve and gas valve inlet adapter whenever they are disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

14. Place the PCB assembly back on to the boiler and tighten the three screws.
15. Check the labels carefully and then connect all the wires.
16. For LP, set DIP SW2 #2 to On. For NG, set DIP SW2 #3 to Off.

WARNING

Ensure that you have turned off the power to the boiler before accessing the DIP switches.



DANGER

- When conversion is required, be sure to set the Front Panel DIP switches according to the supply gas type.
- Failure to properly set the DIP switches could cause carbon monoxide poisoning, resulting in severe personal injury or death.

17. Turn on the gas and water supply to the boiler.
18. Measure and adjust the gas/air ratio.

    Option 1. Using Combustion Analyzer (recommended)

    a. Loosen the screw, rotate the plate and remove the gasket to access the emissions monitoring port as shown in Figure 7.
    b. Insert the analyzer into the port (Figure 7).

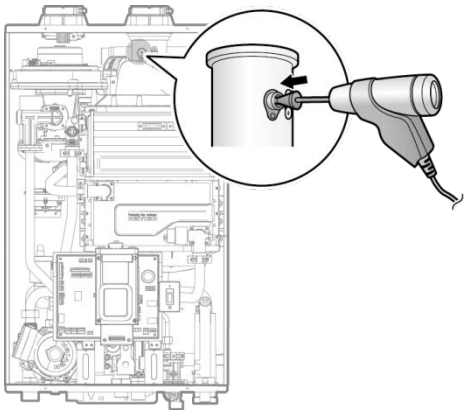


Figure 7

Boiler	Fuel	High fire	Low fire
		%CO_2	**%CO_2**
NCB-180	NG	8.9	9.5
	LP	10.2	10.8
NCB-210	NG	8.9	9.5
	LP	10.2	10.8
NCB-240	NG	8.9	9.5
	LP	10.2	10.8

Table 2. CO_2 and CO value
(CO_2 values must be within 0.5% of the values listed.)

c. Fully open several hot water fixtures and set the boiler to operate at 1-stage MIN mode (refer to "setting the DIP Switches" on page 19 and Operation Condition Setting on page 54).
Measure the CO_2 value at low fire.
If the CO_2 value is not within 0.5% of the value listed in Table 2, the gas valve set screw will need to be adjusted.
If adjustment is necessary, locate the set screw as shown in Figure 8. Using a 5/32" or 4mm Allen wrench, turn the set screw no more than 1/4 turn clockwise to raise or counterclockwise to lower the CO_2 value.

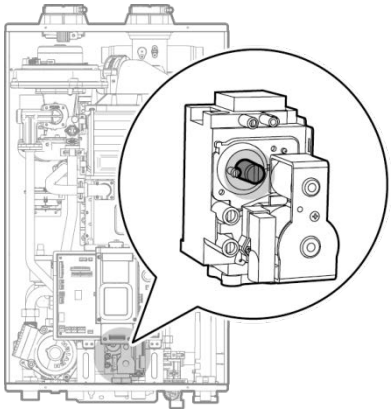


Figure 8. Set Screw Location

NOTE

The set screw is located behind the screw-on cover. This must be removed first.

d. Fully open several hot water fixtures and set the boiler to operate at 2-stage MAX mode (refer to page 19 and page 54). Measure the CO_2 value at high fire.
If the CO_2 values do not match Table 2 at high fire, do not adjust the gas valve. Check for the proper Gas Orifice in Table 3.

DANGER

Improper gas valve settings can cause severe personal injury, death or substantial property damage.

Option 2. Using Digital Manometer

a. Open the offset pressure port by loosening the screw two turns as shown in Figure 9.

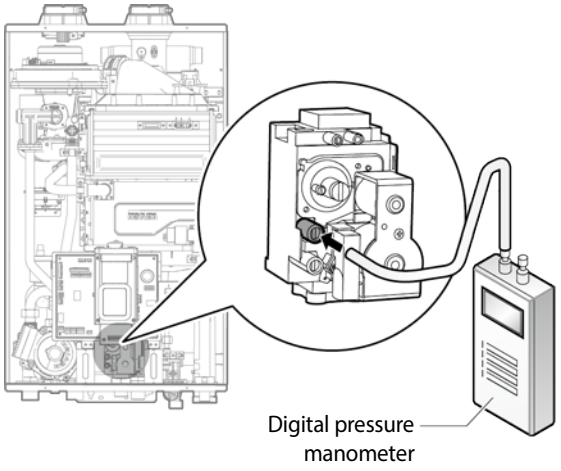


Figure 9. Checking offset Gas Pressure with Manometer

b. Connect a manometer to the offset pressure port. For dual port manometers, use the positive pressure side.

Model	Kit Part No.	Gas Type	Offset
NCB-180	NAC-01	LP	-0.03"±0.01"
	NAC-100	NG	-0.04"±0.01"
NCB-210	NAC-02	LP	-0.02"±0.01"
	NAC-200	NG	-0.04"±0.01"
NCB-240	NAC-03	LP	-0.02"±0.01"
	NAC-300	NG	-0.04"±0.01"

Table 3. Offset values for low fire

c. Fully open a hot water fixture and set the boiler to operate at 1-stage MIN mode (refer to page19 and page 54). Measure the offset value at low fire and compare it to the values in Table . If the offset value is out of range, the gas valve set screw will need to be adjusted.
If adjustment is necessary, locate the set screw as shown in Figure 10. Using a 5/32" or 4mm Allen wrench, turn the set screw no more than 1/4 turn clockwise to raise or counterclockwise to lower the offset value.

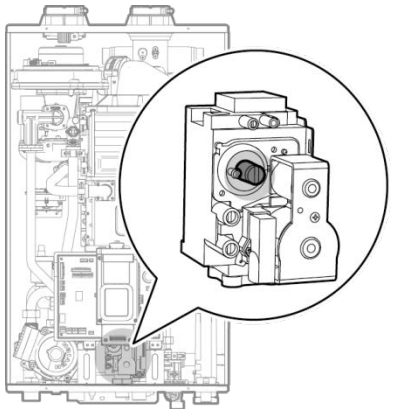


Figure 10

NOTE

The set screw is located behind the screw-on cover. This must be removed first.

d. At high fire, do not check the offset value and never adjust the gas valve.

DANGER

Improper gas valve settings can cause severe personal injury, death or substantial property damage.

Once the CO_2 or offset values have been confirmed, apply the included conversion stickers to show that the appliance has been converted to propane gas. Place this labels adjacent to the rating plate as shown in Figure 11.

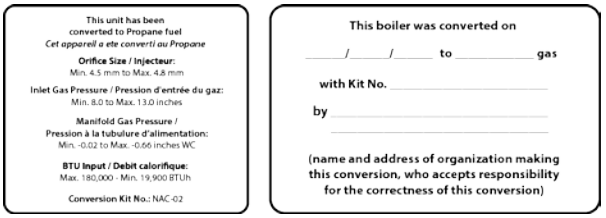

This unit has been
converted to Propane fuel
Cet appareil a ete converti au Propane
Orifice Size / Injecteur:
Min. 4.5 mm to Max. 4.8 mm
Inlet Gas Pressure / Pression d'entrée du gaz:
Min. 8.0 to Max. 13.0 inches
Manifold Gas Pressure /
Pression à la tubulure d'alimentation:
Min. -0.02 to Max. -0.66 inches WC
BTU Input / Debit calorifique:
Max. 180,000 - Min. 19,900 BTUh
Conversion Kit No.: NAC-02
This boiler was converted on
_____/_____/_____ to _____ gas
with Kit No. _____
by _____
_____
(name and address of organization making this conversion, who accepts responsibility for the correctness of this conversion)

Figure 11. Proper Placement of Gas Conversion Labels

4.4 The Front Panel

The front panel allows you to adjust the water temperature and view the operating status or error codes. Remove the protective sheet from the front panel before using it.

4.4.1 LCD Display

DISPLAY (Icon)	Function	Remarks
Heating	Displays Heating icon upon heating demand (Space Heating mode)	
Hot Water	Displays Hot Water icon upon hot water demand (DHW setting mode)	
Supply water Control	Displays the Supply Water Control mode status	
Return Water Control	Displays the Return Water Control mode status	
Segment	Displays the data set in each Segment according to display status	
Combustion	Displays the Combustion status. Flashes the Combustion icon at 1 second intervals when performing combustion freeze protection	
Checkup (Error)	Displays the Error icon when an error occurs. The Boiler may still maintain basic operations (temperature settings, etc.) if it displays the error icon only.	
Outdoor Reset	Displays the Outdoor Reset function status	
GPM	Displays the system flow rate (in GPM)	
Psi	Displays the system water pressure (in psi)	

Segment Status Display	Function	Remarks
WAIT	Shown while waiting for a response from the Main Controller when the Boiler performs an error test or error history load	
RST	Shown on Error Reset	
CLR	Shown on deleting the error history and parameters.	
INIT	Shown on Factory Reset	

4.4.2 Buttons

Button						
Description or Name	Diagnostic	Reset	Power	Mode	Plus	Minus

Short Key	Function	Remarks
[Diagnostic] short key	Display of information for service	
[Mode] short key	Sets heating temperature/hot water temperature Displays/confirms of information for customers	Converts () in order of Setting heating temperature => Setting hot water temperature => Displaying customer information => Setting heating temperature (in Normal Mode only)
[Reset] short key	Error code release/cancellation	
[Plus] short key	Item movement/increase and displays Level 1 Error code (for Level 1 Error status)	
[Minus] short key	Item movement/reduction and displays Level 1 Error code (for Level 1 Error status)	

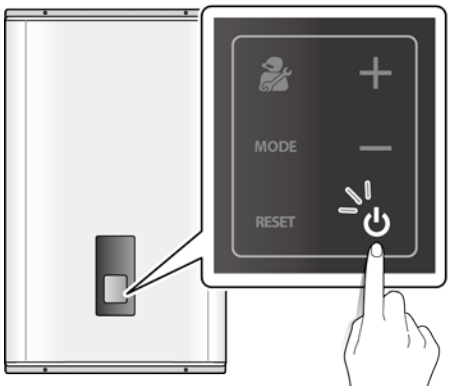
Long Key Combination	Function	Remarks
[Power] long key (300msec)	Power ON / OFF	
[Mode] long key (2 seconds)	Error history display	Must be in normal mode or Error Display mode
[Reset] long key (5 seconds)	Individual deletion of Error History / Tech Data	Works only at the relevant mode
[Diagnostic] long key (5 seconds)	Advancement into Test Menu	Must be in normal mode 1. Parameter Setting 2. Error Check Mode Menu 3. Operation condition setting mode
[Diagnostic] long key (10 Seconds)	Version display	Possible only with power turned OFF
[Diagnostic]+[Plus] +[Reset]+[Power] long key (5Seconds)	Factory reset	Possible only with power turned OFF

※ All button LEDs will be turned on to their maximum when buttons are pressed, and will be turned on at medium brightness at 5 second intervals from the moment they are released and will be completely turned off after maintaining minimal brightness for 5 and 10 second periods.
※ The button will be recognized as pressed once only when released after being pressed for over 50 msec from the time of pressing (Short Key)

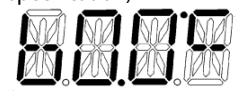
※ If the button is pressed until the Long Key reference time from initial pressing, then it will be recognized as a Long Key at the time the conditions are met.

4.4.3 Turning the Boiler On or Off

To turn the boiler on or off, press the [Power] button.



If the unit is experiencing an error the error code will continue to display on the front panel even if the unit is turned OFF.

Item	Description	Display
Power ON	Normal Operating mode with Power turned On	When the temperature of the present supply water is 120˚F and the water pressure is 12.3psi (Fahrenheit specification) **5 sec flashing** When the temperature of the present supply water is 60.0℃ and its water pressure is 12.3psi (Celsius specification)  **5 sec flashing**
Power OFF	Off status with power Off	All displays off except status icons (the status icon is shown normally according to function status)

※ When the power is first applied, please turn the panel segments and icons on for 3 seconds (in order to check LCD defect)

※ The firmware version of panel will be displayed for 2 seconds after 3 seconds from power application

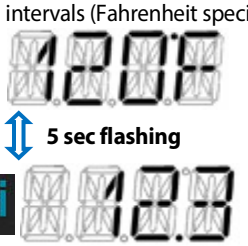
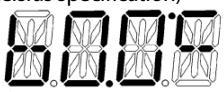
NOTE

If the Air purge is operating, the Segment repeats to display 'AIR' for 5 seconds and water pressure for 5 seconds.

When displaying the water temperature of the space heating supply, the supply or return water icon flashes, depending on the space heating control mode

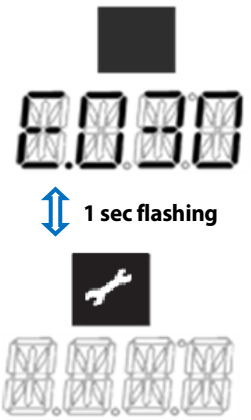
4.4.4 Normal Operation

1. Enter <Normal Operating mode> pressing the [Power] button for more than 300ms at Power Off mode>
2. The Boiler will display the temperature and pressure of present supply water at 5 second intervals.
3. The Segment repeats to display 'AIR' for 5 seconds and water pressure for 5 seconds while Air Purge is in operation
4. When displaying the temperature of present supply water (for 5 seconds) , the Supply water Control and Return Water Control icons flash according to the Heating Control mode.
5. The Psi icon flashes when displaying the water pressure (for 5 seconds)
6. The Error icon flashes at 1 second intervals when a Level 1 error occurs.
7. Pressing the [+] or [-] button briefly when a Level 1 error occurs will convert the Boiler to <Level 1 Error Display mode>. <Level 1 Error Display mode> displays the error code and returns to <Normal Operating mode> after 5 seconds. When the error is released during <Level 1 Error Display mode>, the Boiler will convert to <Normal Operating mode>. However, the Boiler will not accept any input from the button during <Level 1 Error Display mode>.
8. For a Level 1 error, pressing Auto Release or [Reset] button once will release the error after displaying 'RST' for 3 seconds, if the Boiler meets the conditions to release the error.
9. The Boiler operates normally during a Level 1 error.
10. Entering <Error History mode> is available via <Normal Operating mode>.

Item	Description	Display
1. Normal status	Normal Operating mode with power On	When the current supply water temperature is 120°F and the water pressure is 12.3psi, the image below repeats at 5 second intervals (Fahrenheit specification)  **5 sec flashing** When the supply water temperature is 60.0℃ and its water pressure is 12.3psi, the image below repeats at 5 seconds intervals. (Celsius specification)  **5 sec flashing**
2. Air Purge Control Status	Operating mode of Air Purge Function	When the supply water pressure is 12.3 psi, 'AIR' and water pressure will repeat to display at 5 seconds intervals alternately. **5 sec flashing**
3. Level1 Error occurs	Level 1 Error occurrence status	When the current supply water temperature is 120°F and its water pressure is 12.3psi, the image below repeats at 5 seconds intervals. (Celsius specification) Error icon flashes at 1 second intervals. **5 sec flashing**
4. Level1 Error displays	When a level 1 error occurs	When the current error is Level 1, the 218 (error code will display for 5 seconds), Error icon flashes at 1 second intervals. 1 sec flashing after display of 5sec

4.4.5 Error Display and RESET

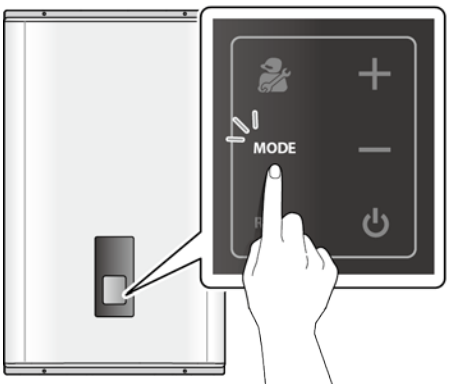
1. When an error higher than Level 2 occurs (the Boiler may stop operation or only has basic functions), the Boiler enters <Error Display mode> directly at <Normal Operating mode> or <Power Off mode>.
2. When an error occurs at other panel modes, only the Error icon flashes and it enters <Error Display mode> after terminating the current mode.
3. The Error icon and error code flash alternately at 1 second intervals at <Error Display mode>.
4. The error code displays 3 digits.
5. Entering Service Info, Error History or Special Parameter mode is available at <Error Display mode>.
6. When pressing the [Reset] button once while the error code is displayed, the error will be released after 'RST' displays for 3 seconds if the Boiler meets the conditions to release the error. If releasing the error is not possible, the error code will display again after 3 seconds.
7. When releasing the error by pressing the [Reset] button once or it is automatically released at <Error Display mode>, the Boiler returns to <Power Off mode> after releasing the error, if the error occurred in a specific mode (Power OFF, Test, or Parameter Setting mode) .

Item	Description	Display
		

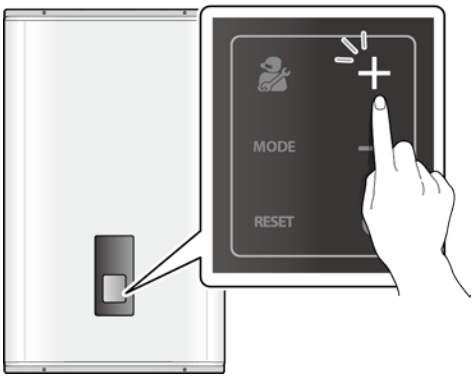
4.4.6 Adjusting the Space Heating Temperature

The boiler is set to 140°F (60°C) by default. To adjust the space heating water temperature:

1. Press the Mode button once. The space heating icon turns on.



2. Press the + (Up) or – (Down) buttons until the desired temperature appears on the display.



3. You can adjust the temperature while the display is flashing. Once the display stops flashing, the temperature setting is stored.

NOTE

- Take note of the original heating temperature in case you want to restore it to the default.
- The default space heating supply water temperature range is 104°F (40°C, Absolute MIN) to 180°F (82°C, Absolute MAX).
- The default space heating return water temperature range is 86°F (30°C, Absolute MIN) to 149°F (65°C, Absolute MAX).
- You can adjust the temperature range in the parameter settings menu.
- The boiler will retain your settings during a power outage.

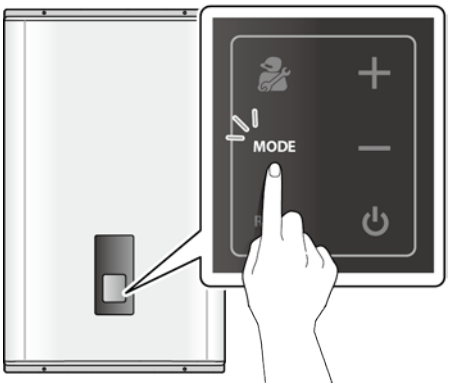
4.4.7 Adjusting the DHW Temperature

WARNING

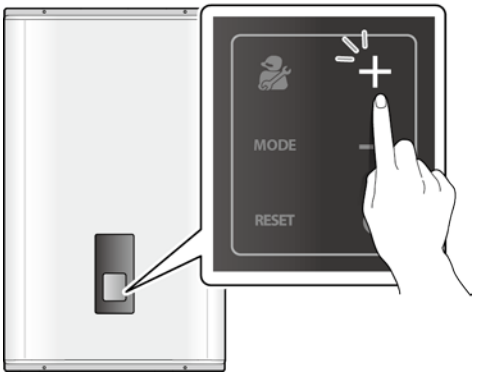
Before adjusting the water temperature, read "To prevent burns:" on page 9 carefully. Water above 120°F (52°C) can cause instant scalding, severe burns, or death.

To adjust the water temperature:

1. Make sure that all hot water faucets are closed, and ensure that the internal circulator and any external circulating pumps are off.
2. Press the Mode button twice. The DHW mode icon turns on.



3. Press + (Up) or − (Down) buttons until the desired temperature appears on the display.



4. You can adjust the temperature while the display is flashing. Once the display stops flashing, the temperature setting is stored.

Temperature range	Adjusting the water temperature
86~120°F (Fahrenheit mode) 30-50°C (Celsius mode)	1°F or 1°C increments
120~140°F (Fahrenheit mode) 50-60°C (Celsius mode)	Press for 2 seconds to adjust in 5°F or 2°C increments

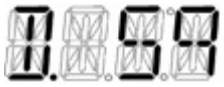
NOTE

The boiler will retain your settings during a power outage.

4.4.8 Viewing Basic Information (For Homeowner)

To view information about the boiler, press the [Mode] button three times. "INFO" will appear in the display.

Press the [+] or [–] buttons to switch between the information types.

Item	Description	Display
(A) Space heating supply water temperature	Display of the current space heating outgoing water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (°F) mode; ex) 120°F
(B) Space heating return water temperature	Display of the current space heating incoming water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (°F) mode; ex) 120°F
(C) Domestic hot water outlet temperature	Display of the current outgoing water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (°F) mode; ex) 120°F
(D) Cold water inlet temperature	Display of the current incoming water temperature	For Celsius (℃) mode; ex) at 15℃
		For Fahrenheit (°F) mode; ex) 59°F 

Item	Description	Display
(E) Flow rate	Display of the current flow rate Minimum display unit (0.2 Gal/min or l/min)	Using sensor GPM flow rate display ex) 10.2GPM
(F) Outdoor air temperature (with optional Outdoor Temperature Sensor only)	Display of current outdoor temperature	Outdoor Temperature display for Celsius (℃) mode with optional sensor, ex) at 15℃
		Outdoor Temperature display for Fahrenheit (°F) mode with optional sensor, ex) at 59°F
(G) Outdoor reset curve	Display of heat load (1~7)	If Finned Tube Baseboard is set; 1 : Finned Tube Baseboard 2 : FAN Coil 3 : Cast Iron Baseboard 4 : Low Mass Radiant 5 : High Mass Radiant 6 : Radiator 7 : Custom (set by installer)
		If Outdoor Reset is not used;
(H) Boost interval time (Set by installer)	Display of boost interval set (0~120 min)	If Boost interval time is set at 30 minutes;
(I) Water pressure	Display of current water pressure	Using sensor in psi ex) 12.3 psi

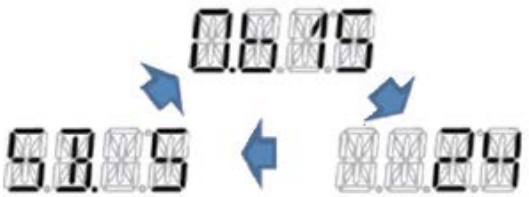
To exit information mode, press the [Reset] button.

4.4.9 Error occurrence history display

1. At the <Normal operation mode> or <Error history display mode>, press the [Info] button for over 2 seconds to access the error history mode.
   The most recent error will be displayed first.
2. When the [+] / [-] button is pressed, the error history can be searched. A total of 10 errors are stored in memory and are labeled from 0 to 9 with 0 being the most recent error.
3. Whenever the [Info] button is pressed, the previous error occurrence time difference (unit time, maximum 9999 hr) and the sub error code are toggled and displayed.
4. Pressing the [Reset] button for 5 seconds while in the <ERROR HISTORY DISPLAY MODE> displays "CLR" and deletes all the ERROR HISTORY DATA.
5. Press the [Reset] button once to return to the <Normal operation mode>.
6. If there is no button input for 5 minutes, then it automatically returns to the <Normal operation mode>.

NOTE

- While in <ERROR HISTORY DISPLAY MODE> the first digit indicates the history of the error with 0 being the most recent. The remaining 3 digits indicate the error code. If there is no error history, a "0" will be displayed.
- Passed time display: The time between the currently displayed error and the just previously generated error is displayed in 1-hr unit.
- ("0" is displayed if the error code is empty)
- Ex) When the most recent error code is 615, the sub error code is 5, and 24 hours have passed since the error was generated.

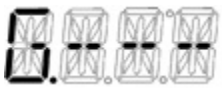


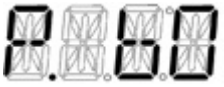
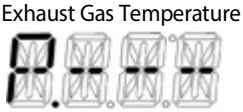
- When the Sub Error Code is "0" (i.e., there is no sub error code), the display is as follows:

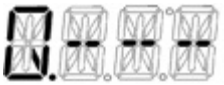
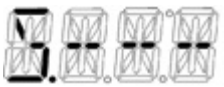
4.4.10 information display (for servicer)

1. At the <Normal operation mode>, press the [Diagnostic] button once for 5 seconds to access the service information display.
2. Whenever the [+] / [-] button is pressed, the Information Data items are increased/decreased and displayed.
3. The current Information Data item is identified with a letter prefix followed by 3 digits of the relevant data.
4. Press the [Reset] button once to return to the <Normal operation mode>.
5. If there is no button input for 1 hour, then it automatically returns to the <Normal operation mode>.

Item	Description	Display
(A) Space heating supply water temperature	Display of the current space heating outgoing water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (˚F) mode; ex) 120˚F
(B) Space heating return water temperature	Display of the current space heating incoming water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (˚F) mode; ex) 120˚F
(C) Domestic hot water outlet temperature	Display of the current outgoing water temperature	For Celsius (℃) mode; ex) at 60℃
		For Fahrenheit (˚F) mode; ex) 120˚F
(D) Cold water inlet temperature	Display of the current incoming water temperature	For Celsius (℃) mode; ex) at 15℃
		For Fahrenheit (˚F) mode; ex) 59˚F

Item	Description	Display
(E) Flow rate	Display of the current flow rate Minimum display unit (0.2 Gal/min or l/min)	Using sensor GPM flow rate display ex) 10.2GPM
(F) Outdoor air temperature (with optional Outdoor Temperature Sensor only)	Display of current outdoor temperature	Outdoor Temperature display for Celsius (℃) mode with optional sensor, ex) at 15℃
		Outdoor Temperature display for Fahrenheit (°F) mode with optional sensor, ex) at 59°F
(G) Outdoor reset curve	Display of heat load (1~7)	If Finned Tube Baseboard is set; 1: Finned Tube Baseboard 2: FAN Coil 3: Cast Iron Baseboard 4: Low Mass Radiant 5: High Mass Radiant 6: Radiator 7: Custom (set by installer)
		If Outdoor Reset is not used; 
(H) Boost interval time (Set by installer)	Display of boost interval set (0~120 min)	If Boost interval time is set at 30 minutes;
(I) Water pressure	Display of current water pressure	Using sensor in psi ex) 12.3 psi

Item	Description	Display
(J) Heat Capacity	Display of current heat capacity % range: 50~100% Default : 100%	% Heat capacity display in percentage ex) 100%,
(K) Flame State	Display of flame detection current AD value Flame ON : Below 70 Flame OFF : Over 175	Displays the flame by flame detection AD value (0~255) , ex) 200
(L) Target RPM	Target fan motor RPM display	Displays RPM deleting the 1st digit, ex) 3600rpm,
(M) Current RPM	Current fan motor RPM display	Display of RPM by omitting the last digit, ex) 3600 rpm,
(N) Target APS	Target APS voltage value display	Display of the APS value as voltage up to the first decimal place, ex) 3.2V;
(O) Current APS	Current APS voltage value display	Display of the APS value as voltage up to the first decimal place, ex) 3.2V;
(P) Exhaust Gas Temperature	Current exhaust gas temperature display	Exhaust Gas Temperature display for Celsius (℃) mode with sensor, ex) 60℃ 
		Exhaust Gas Temperature display for Fahrenheit (°F) mode with sensor, ex) 120°F
		Exhaust Gas Temperature display without sensor 

Item	Description	Display
(Q) Model and Capacity	Currently set model and capacity display The 2nd & 3rd digits represent the model and the 4th digit represents the type of market.	ex) Capacity 180, condensing for the American market
		ex) Capacity level 240, for the Korean market
		ex) Setting error 
(R) Information on Gas Type	Display of current gas	NG
		LP
(S) Altitude setting information	Display of current altitude level setting	0~2,000ft 
		2,000~5,400ft
		5,400~7,700ft
		7,700~10,100ft

4.4.11 Special Parameter mode

You can modify parameter settings for boiler operations, such as the space heating and DHW temperature ranges, in different operating conditions. Follow the instructions below to access the Special Parameter mode and change the available settings

> **CAUTION**
>
> Parameters must be set by a qualified professional with an extensive understanding of the boiler system. Setting parameters improperly may lead to property damage or injury.

1. Press and hold the Diagnostic button for 5 seconds to enter the Special Parameter mode.
2. Press the + or － buttons at Special Parameter Mode. (refer to the table below)

Item	Description	Display
(1) Parameter Setting Mode	Sets the Boiler parameters.	
(2) Error Checking Mode	Used to test the normal operation of each device.	
(3) Operation condition Setting Mode	Used to test the operation condition of the boiler.	

3. Press the [MODE] Button once enters boiler to the currently displayed mode
4. Press the [RESET] button once returns the boiler to the Normal Operating Mode.
5. The boiler will automatically return to the Normal Operating Mode, if there is no input from the + or – button for 5 seconds.

(1) Parameter setting Mode

1. Press and hold the Diagnostic button for 5 seconds to enter the Special Parameter mode.
2. Press the + or – button to move to "1.PAR"(Parameter Setting mode), You will be asked to enter a password ("PASS" is displayed)
3. Press the Mode button and enter your 4-digit password. (Factory Default PASSWORD : 1234)
4. Use the + or － buttons to increase or decrease numbers and the Diagnostic button to move between digits.
5. When you are done, press the Mode button.
6. Press the + or － buttons to move to a parameter setting, and then press the Mode button to enter the Parameter Edit mode.
7. Press the + or － buttons to change the parameter value.
8. When you are done, press the Mode button to save the settings.

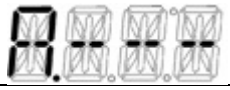
CAUTION

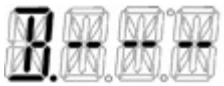
- If you enter an incorrect password 10 times or make no input 5 minutes, the boiler will return to the Normal Mode.
- To return to the previous mode, press the Reset button.
- The Factory default password is "1234"
- If you make no adjustment for 10 seconds in the Parameter Edit mode, the current parameter value will be saved automatically.
- Press and hold the Reset button in Parameter Edit mode for 5 seconds to reset all settings to their default values.
- When you reset one of the following parameters, the corresponding parameter will be reset automatically.

  Supply absolute MIN or MAX

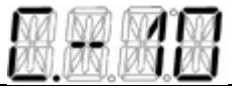
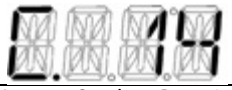
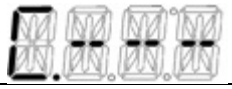
  Return absolute MIN or MAX
- Lowest Outdoor Temperature or Highest Outdoor Temperature

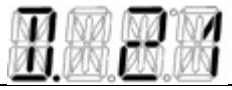
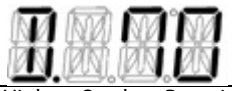
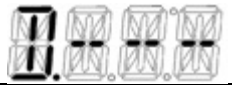
<table>
<tr><th>Item</th><th>Description</th><th>Display</th></tr>
<tr><td>(A) Outdoor Reset Use Setting</td><td>This mode is used to configure the Outdoor Reset Control mode.
This mode is disabled by default from the factory.</td><td>Outdoor Reset in use

Outdoor Reset not in use
  </td></tr>
<tr><td>(B) Outdoor Reset Heat Road Setting</td><td>This mode is used to configure the heat load type to be used with the Outdoor Reset Control mode.
A preset or user-defined temperature range is selected automatically based on the heat load type selected.
<table>
<tr><th>Heat Load</th><th>Supply Set-point Range</th><th>Return Set-point Range</th><th>Remarks</th></tr>
<tr><td>1. Finned Tube Baseboard</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td>Default</td></tr>
<tr><td>2. FAN Coil</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td></td></tr>
<tr><td>3. Cast Iron Baseboard</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td></td></tr>
<tr><td>4. Low Mass Radiant</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td></td></tr>
<tr><td>5. High Mass Radiant</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td></td></tr>
<tr><td>6. Radiator</td><td>120-180°F (48.5-82℃)</td><td>120-180°F (48.5-82℃)</td><td></td></tr>
<tr><td>7. Custom</td><td>Supply Control Absolute MIN/MAX Set-Point</td><td>Return Control Absolute MIN/MAX Set-Point</td><td>User-Defined</td></tr>
</table>
Heat loads 1-6 show the preset temperature ranges based on the load type selected, while heat load 7 provides a custom temperature range. When the custom temperature range is in use, the boiler operates based on the user-defined "Absolute Min" and "Absolute Max" temperature settings.</td><td>Outdoor Reset heat road types (1-7)

Outdoor Reset heat load not selected
  </td></tr>
</table>

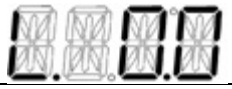
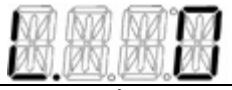
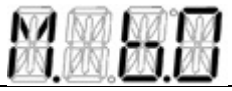
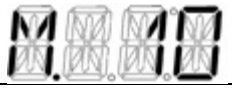
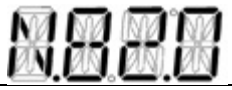
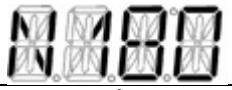
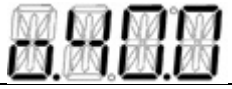
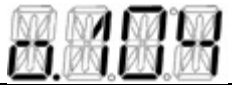
<table>
<tr><th>Item</th><th>Description</th><th>Display</th></tr>
<tr><td>(C) Lowest Outdoor Temperature Setting</td><td>This mode is used to configure the lowest outdoor temperature. The boiler will operate at the high end of the supply or return set-point range at this outdoor temperature.

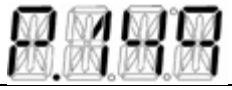
Outdoor Low Temperature Setting Range<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>-4°F(-20℃) ~ [Outdoor High Temperature Set-point - 9°F (5℃)]</td><td>14°F (-10℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at - 10℃
 
For Fahrenheit (°F) mode; ex) at 14°F
 
Lowest Outdoor Reset is not used
  </td></tr>
<tr><td>(D) Highest Outdoor Temperature Setting</td><td>This mode is used to configure the highest outdoor temperature. The boiler will operate at the high end of the supply or return set-point range at this outdoor temperature

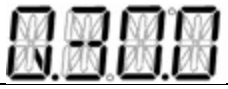
Outdoor Low Temperature Setting Range<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>[Outdoor Low Temperature Set-point + 9°F(5℃)] ~ 104°F(40℃)</td><td>70°F (21℃)</td></tr></table></td><td>For Celsius (℃) mode; ex)at 21℃
 
For Fahrenheit (°F) mode; ex) at 70°F
 
Highest Outdoor Reset is not used
  </td></tr>
<tr><td>(E) Boost Interval Time Setting</td><td>The boost interval time may be set to prevent interruption in space heating while using the Outdoor Reset Control mode, due to changes in heat load conditions. With the boost interval time enabled, the boiler increases the space heating supply temperature by 9°F(5℃) and the return temperature by 5°F(3℃) after a set time elapses.<table><tr><th>Setting</th><th>Range</th><th>Remarks</th></tr><tr><td>Boost Interval Time</td><td>0-120 min (0 : OFF)</td><td>Default: OFF (0)</td></tr><tr><td rowspan="2">Boost Temperature</td><td>Space Heating Supply (Fixed Value): 9°F(5℃)</td><td></td></tr><tr><td>Space Heating Return (Fixed Value): 5°F(3℃)</td><td></td></tr></table></td><td>If Boost Interval Time set is 30 minutes
 </td></tr>
<tr><td>(F) Max Limited Calorie for Heating</td><td>This menu is used to configure the desired space heating capacity. When the boiler operates in the Normal mode, the space heating capacity is limited to the set value (%)<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>50-100%</td><td>100%</td></tr></table></td><td>MAX limited calorie for Space heating is 95%
 </td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th><th>Display</th></tr>
<tr><td>(G) Pump Freezing Temperature Setting</td><td>This menu is used to configure the circulation pump freeze protection temperature.
When the space heating supply temperature stays below the set value for longer than 10 seconds, the boiler runs the circulation pump to prevent freeze damage (the pump runs for 10 minutes, then stops for 1 minute).<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>43-50°F(6-10℃)</td><td>50°F(10℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 10℃

For Fahrenheit (°F) mode; ex) at 50°F
 </td></tr>
<tr><td>(H) Anti Fast Cycling Time</td><td>The anti-fast cycling time is the duration that the boiler stops its space heating operation when the space heating supply or return temperatures reach the set values for boiler operation stop temperatures. The boiler will not resume space heating until the duration elapses, even when the space heating supply or return temperatures return to within the set ranges.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>0-20 minutes</td><td>3 minutes</td></tr></table></td><td>If Anti Fast Cycling Time set is 3 minutes
 </td></tr>
<tr><td>(I) CH Pump Over-run Time</td><td>The pump overrun time is the duration that the circulation pump will continue to run when the space heating supply or return temperatures reach the set values for boiler operation stop temperatures and the burner turns off. If the space heating supply or return temperature remains out of the boiler operation temperature range after the set time, the boiler stops the pump for 10 minutes, runs it again for 5 minutes, and then repeats the cycle.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>3-40 minutes</td><td>40 minutes</td></tr></table></td><td>If CH PUMP Over-run Time set is 40 minutes
 </td></tr>
<tr><td>(J) Max Limited Calorie for Hot water</td><td>This menu is used configure the desired DHW capacity. When the boiler operates in the Normal mode, the DHW capacity is limited to the set value (%)<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>50-100 %</td><td>100 %</td></tr></table></td><td>If Max limited hot water calories is 100%
 </td></tr>
<tr><td>(K) DHW Wait Time</td><td>The DHW wait time is the duration that the boiler maintains the DHW supply mode after a DHW demand. With the DHW wait time enabled, a faster DHW supply may be available when there is a subsequent DHW demand. The boiler switches the 3-way valve to space heating mode when the set time elapses.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>0-20 minutes</td><td>5 minutes</td></tr></table></td><td>If DHW Wait Time set is 5 minutes
 </td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th><th>Display</th></tr>
<tr><td>(L) CH Burning OFF Differential</td><td>During space heating, the boiler turns off the burner when the space heating supply temperature meets or exceeds the burner-off temperature.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>0-54°F(0-30℃)</td><td>0°F(0℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 0℃
 
For Fahrenheit (°F) mode; ex) at 0°F
  </td></tr>
<tr><td>(M) CH Burning ON Differential</td><td>During space heating, the boiler turns on the burner when the space heating supply temperature is below the burner-on temperature.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>5-54°F(3-30℃)</td><td>5°F(3℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 6℃
 
For Fahrenheit (°F) mode; ex) at 10°F
  </td></tr>
<tr><td>(N) Supply Absolute MAX Set-point</td><td>This menu may be used to make changes to the maximum supply temperature range when the Supply Control mode is in use. When configuring the Custom mode in the Outdoor Reset Control mode, the supply temperature changes based on the supply absolute MAX temperature range.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>[MIN Set-point + 36°F(20℃)] ~ 194°F(90℃)</td><td>180°F(82℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 82℃ (feed water control)
 
For Fahrenheit (°F) mode; ex) at 180°F
  </td></tr>
<tr><td>(O) Supply Absolute MIN Set-point</td><td>This menu may be used to make changes to the maximum supply temperature range when the Supply Control mode is in use. When configuring the Custom mode in the Outdoor Reset Control mode, the supply temperature changes based on the supply absolute MIN temperature range.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>77°F(25℃) ~ [MAX Set-point - 36°F(20℃)]</td><td>104°F(40℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 40℃
 
For Fahrenheit (°F) mode; ex) at 104°F
  </td></tr>
<tr><td>(P) Return Absolute MAX Set-point</td><td>This menu may be used to make changes to the maximum return temperature range the Return Control mode is in use. When configuring the Custom mode in the Outdoor Reset Control mode, the return temperature changes based on the return absolute MAX temperature range.<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>[MIN Set-point + 18°F(10℃)] ~ 158°F(70℃)</td><td>149°F(65℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 65℃

For Fahrenheit (°F) mode; ex) at 149°F
  </td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th><th>Display</th></tr>
<tr><td>(Q) Return
Absolute MIN
Set-point</td><td>This menu may be used to make changes to the maximum return temperature range the Return Control mode is in use. When configuring the Custom mode in the Outdoor Reset Control mode, the return temperature changes based on the return absolute MIN temperature range.
<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>68°F(20℃) ~ [MAX Set-point - 18°F(10℃)]</td><td>86°F(30℃)</td></tr></table></td><td>For Celsius (℃) mode; ex) at 30℃
 
For Fahrenheit (°F) mode; ex) at 86°F
 </td></tr>
<tr><td>(R) AWS Operation
Pressure
Setting</td><td>This menu may be used to allow the boiler to maintain the space heating system water pressure to ensure that a sufficient amount of water is in the system. When the system pressure falls 4 PSI below the set value, the boiler opens the makeup water feeding valve for a maximum of 2 minutes until the system is filled and water pressure exceeds the set value. After filling the system, the boiler runs the circulation pump for 15 seconds in the space heating mode before completing the process. The makeup water feeding valve operates only when there is no space heating or DHW demand.
<table><tr><th>Setting range</th><th>Default</th></tr><tr><td>12-30 PSI</td><td>12 PSI</td></tr></table></td><td>If water pressure is 18 psi
 </td></tr>
<tr><td>(S) All Parameters
Initialization</td><td>This menu may be used to initialize all the parameters set with the boiler.
To initialize all parameters.
Press the + or – buttons to change the display “yes”
Press the “Mode” button.
When “No” appears on the display again, press the “mode” button.</td><td>If entering <Parameter Initializing mode>,

press [+] / [-] button,

or
 </td></tr>
<tr><td>(T) Password
Change mode</td><td>This menu may be used to set a new password to access the parameter setting menu.
To set a new password:
1. Move to [T.PSC] and press the “Mode” button. The current password is displayed, with the first digit flashing.
2. Press the + or – buttons to change numbers.
3. Press the [Diagnostic] button to change places.
4. When you are done setting the password, press the [Mode] button to save it. The new password is displayed on the front panel for 3 seconds, before the boiler returns to the parameter setting mode.
NOTE
If you do not press the [Mode] button for 10 seconds after setting a new password, the new password is automatically saved and [T.PSC] is displayed on the front panel.</td><td>When entering <Password Change mode>, the password set will be displayed.
The 1st Segment of password set flashes at 500ms intervals.</td></tr>
</table>

(2) Error Checking mode

1. While in <Special Parameter mode>, press the [+] / [-] button and then press the [Mode] button once "2.TST" is displayed on the front panel.
2. After accessing <Error Checking Mode>, make sure that the boiler is not operating (stop flow)
3. Increase / decrease and change the component check menu item with the [+] / [-] button.
4. For an item not supported by the current model, do not display the item but skip it. (Depending on the DIP SW setting)
5. Press the [Mode] button once to display "WAIT", execute the component check operation for the relevant item, and return to the <Troble Check mode> after operation ends. (exdluding the 3-way valve and Dual Venturi Test).
6. During the component check operation, a test is automatically performed without pressing additional buttons (except the 3-Way Valve and Dual Venturi Test).
7. The 3-Way Valve and Dual Venturi test function is to perform an On / Off manual operation test with the [+], [-] buttons, and if the [Reset] button is pressed or there is no key input for 5 minutes, then it returns to the "D.VEN" display item.
8. Press the [Reset] button once to return to <Special Parameter mode>. (To the display of the previously entered item "2. TST" display)
9. If there is no button input for 5 minutes, it automatically returns to the <Special Parameter mode>.

Item	Description	Display
FAN Motor	Fan motor component check menu display	
Pump	Pump component check menu display	
3-Way Valve	3-Way Valve component check menu display	
Dual Venturi	Dual Venturi component check menu display	

Component	Test Performed	Display Method
Fan	Gradually increase / decrease the speed of the fan motor starting from 0 RPM to full speed and back down to 0 RPM	The current APS value and the current RPM value are repeatedly displayed at intervals of 2 seconds.
Pump	Cycles the pump 10 seconds ON and 5 seconds OFF five times. (Repeats five times for a total of 75 seconds)	Displays On or Off according to pump status
3-Way Valve	3-Way Valve will be turned On upon entering <Test mode> and pressing the [+], [-] button each time converts the state from On -> Off or Off -> On	Whenever the [+], [-] button is pressed, the condition is toggled as On -> Off or Off -> On
Dual Venturi	Dual Venturi will be turned On upon entering <Test mode> and pressing the [+], [-] button each time converts the state from On -> Off or Off -> On	Whenever the [+], [-] button is pressed, the condition is toggled as On -> Off or Off -> On

※ Error Check Operation will return to Normal Operation condition after automatic test when selecting each operation mode (3-Way Valve and Dual Venturi will be manually controlled)

(3) Operation conditions Settings

1. While in <Special Parameter mode>, press the [+] / [-] button and then press the [Mode] button once when "3. OPR" is displayed on the front panel.
2. Whenever the [+] / [-] button is pressed, it increases / decreases the operation condition and flashes at intervals of 500msec. If the condition is not changed for 3 seconds, it works at the displayed operation condition.

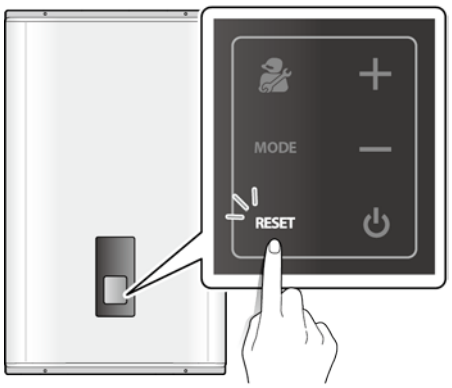
> a) NORMAL Operation condition → b) 1-Stage MIN → c) DHW 1-Stage MAX →
> d) 2-Stage MIN → e) DHW 2- Stage MAX → f) CH 1st Stage MAX →
> g) CH 2nd Stage MAX → a) NORMAL Operation condition) ……

3. If the [Reset] button is pressed once, then it returns to the <Special Parameter mode>. (Displayed as the previously entered item "3. OPR")
4. If there is no button input for 3 hours, then it automatically returns to the <Normal Operation mode>.

Mode	Description	Display
(a) NORMAL Operation condition	Operated in a Normal operation mode	
(b) 1st Stage MIN Operation condition	Operated in a 1-Stage MIN operation mode	
(c) DHW 1st Stage MAX Operation condition	Operated in a DHW 1-Stage MAX operation mode	
(d) 2nd Stage MIN Operation condition	Operated in a 2-Stage MIN operation mode	
(e) DHW 2nd Stage MAX Operation condition	Operated in a DHW 2-Stage MAX operation mode	
(f) CH 1st Stage MAX Operation condition	Operated in a CH 1-Stage MAX operation mode	
(g) CH 2nd Stage MAX Operation condition	Operated in a CH 2-Stage MAX operation mode	

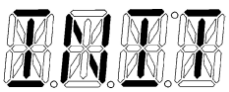
4.4.12 Resetting the Boiler (Factory Reset)

If an error message appears, you can try resetting the boiler to resolve the problem. To reset the boiler, press the Reset button.



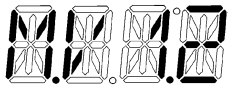
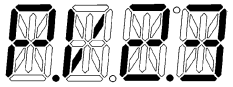
If resetting the boiler does not solve the problem, refer to the Troubleshooting section of this manual or contact Technical Support at 1-800-519-8794.

1. Pressing the [Diagnostic]+[Plus]+[Reset]+[Power] buttons at <Power Off mode> for more than 5 seconds will initialize the system to its factory reset and the system will convert its mode to <Normal Operating mode> after displaying 'INIT' on Segments for 5 seconds.
2. Reset Value:
3. For Fahrenheit (℉): Supply water temperature is to be set at 140℉, Return water temperature is to be set at 120℉ and Temperature of hot water is to be set at 120℉.
4. For Celsius (℃): Supply water temperature is to be set at 60℃, Return water temperature is to be set at 50℃ and hot water temperature is to be set at 50℃.

Command	Description	Display
FACTORY RESET	Displays for 5 seconds	

4.5 Version Display

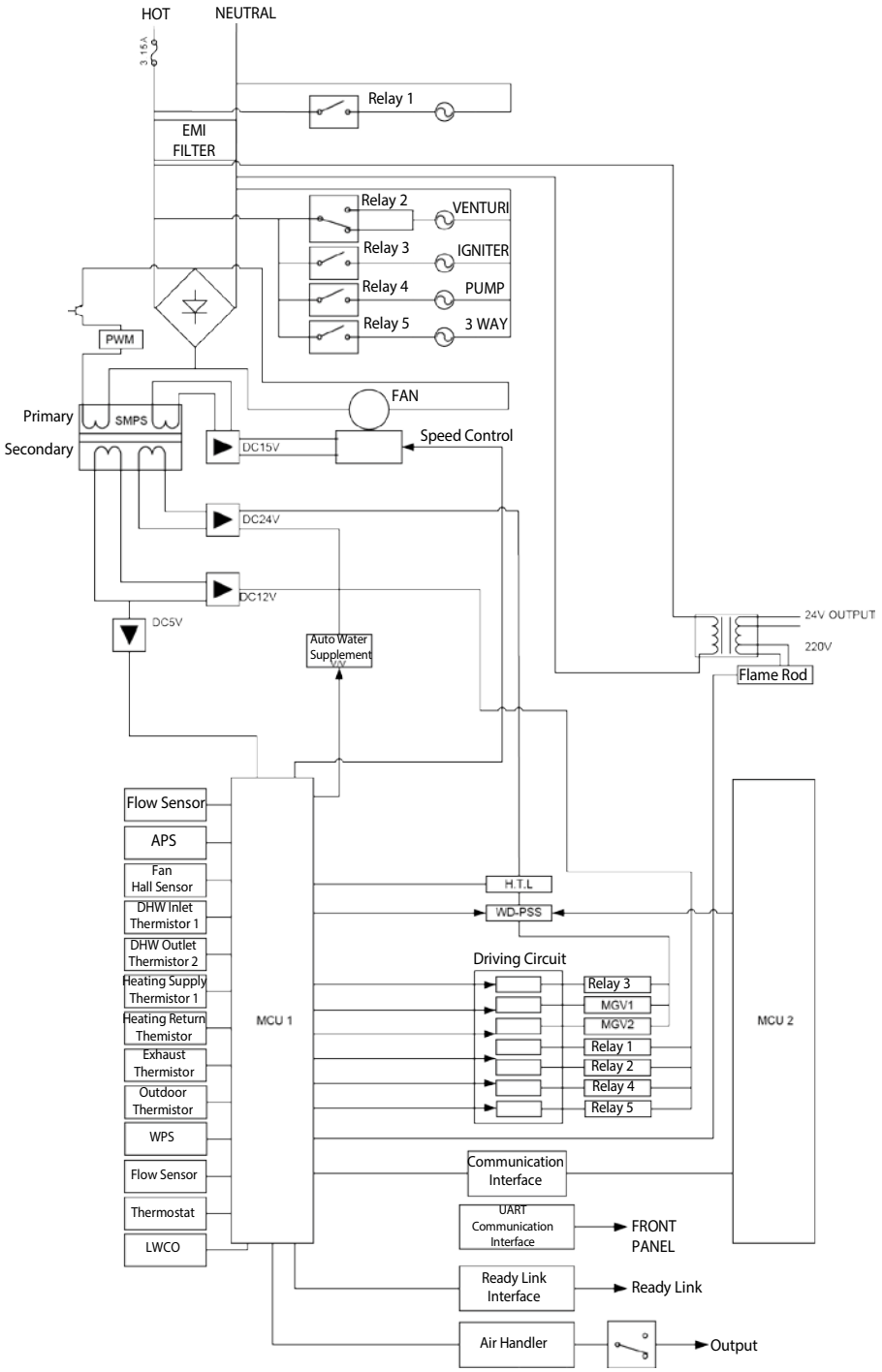
Press the [Diagnostic] button for more than 10 seconds at <Power Off mode> will display the Main Controller firmware version for 3 seconds, display the Panel firmware version for 3 seconds and return the system to <Power Off mode>.

Item	Description	Display
(a) Main Controller F/W Version	Displays for 3 seconds Ex > Ver 1.2	
(b) Panel F/W Version	Displays for 3 seconds Ex > Ver 2.3	

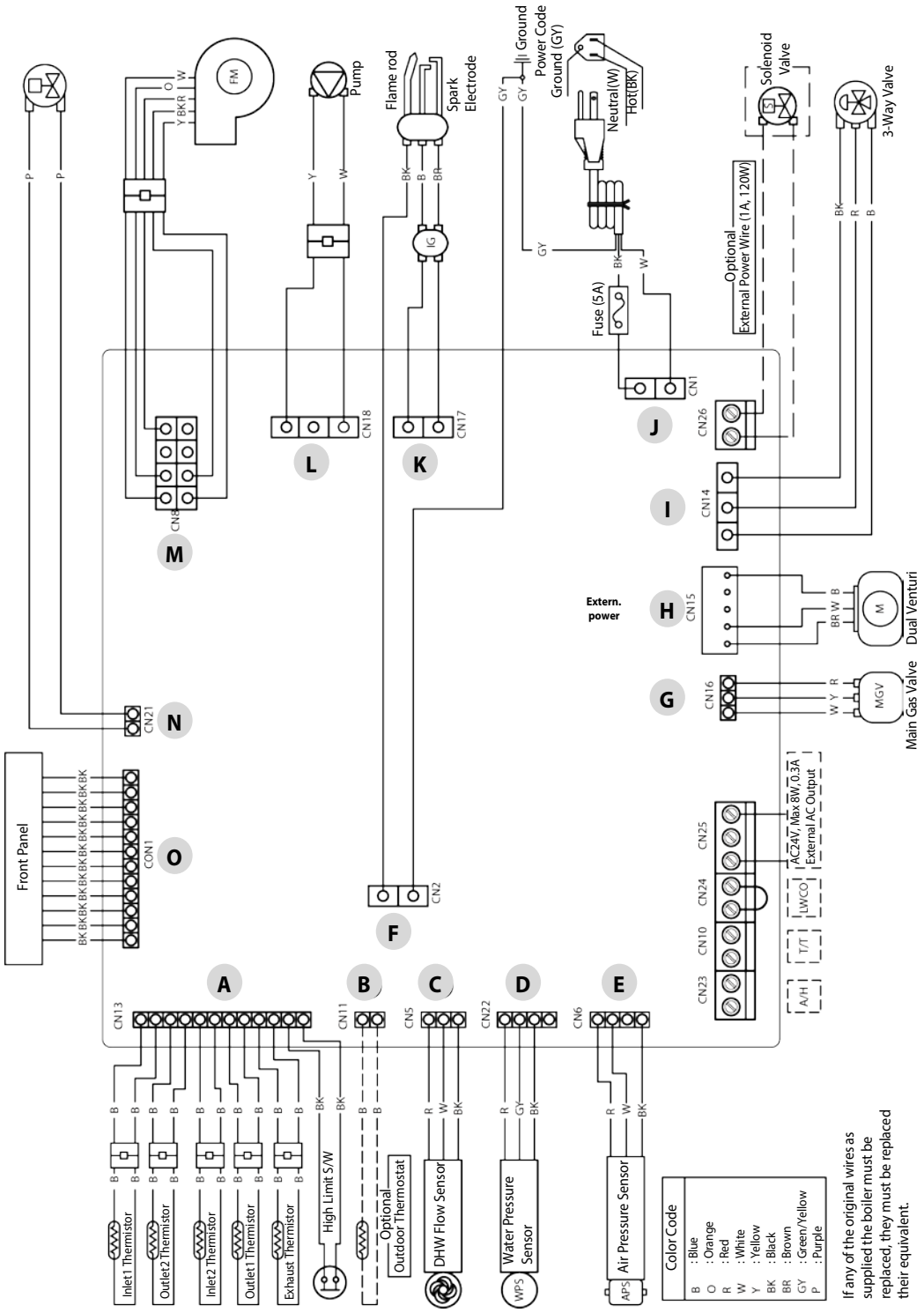
4.6 Error Codes

Item	Error Code	Conditions
(a) Panel Communication Error	E782 (Level 1)	Automatically releases the error code when the main controller doesn't answer for 60 seconds but the system operates normal communications once. The error code will be displayed first on the Panel Controller regardless of error level when a Panel Communications Error occurs (as it is not possible to know the Controller error status if communication with the Controller is not available)
(b) Key Error	E593 (Level 1)	A Key Error occurs when Touch IC IIC Communication is not available for more than 1 minute and will be automatically released when normal operating conditions are met.

4.7 Ladder Diagram



4.8 Electrical Diagnostic Point & Wiring Diagram



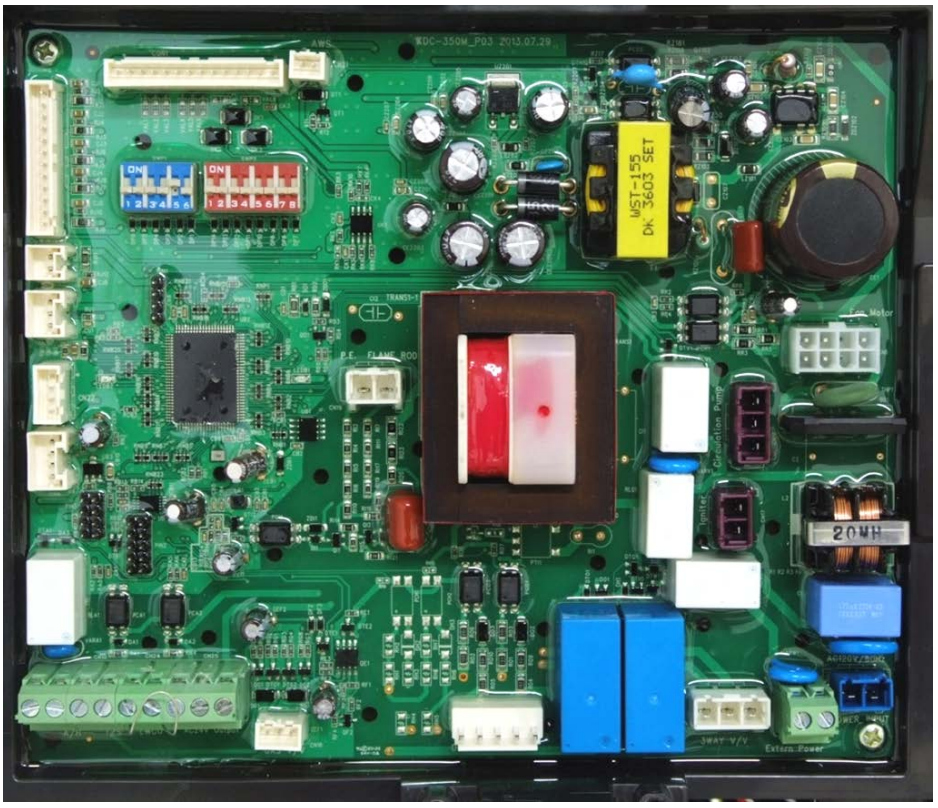
Point	Function	CN No.	Wire Color	Normal Value	Check
A	DHW Inlet Temperature Sensor	CN13 1-2	BLUE-BLUE	DC 0~5V	Voltage changes according to temperature.
	HEATING Return Temperature Sensor	CN13 3-4	BLUE-BLUE	DC 0~5V	Voltage changes according to temperature.
	DHW outlet Temperature Sensor	CN13 5-6	RED-RED (BLUE-BLUE)	DC 0~5V	Voltage changes according to temperature.
	HEATING Supply Temperature Sensor	CN13 7-8	BLUE-BLUE	DC 0~5V	Voltage changes according to temperature.
	Exhaust Sensor	CN13 9-10	BLUE-BLUE	DC 0~5V	Voltage changes according to temperature.
	High Temperature Limit Switch	CN13 11-12	BLACK-BLACK	DC 0V	Normally Shorted. Confirm RMS voltage.
B	Outdoor sensor	CN11	-	DC 0~5V	Voltage changes according to temperature.
C	Flow Sensor	CN5 1-3	RED-BLACK	DC 12V	Confirm steady voltage.
		CN5 2-3	WHITE-BLACK	PULSE	Check Pulse.
D	Water Pressure Sensor	CN22 1-2-3	RED-YELLOW(GREEN)-BLACK		
E	APS	CN6 1-2	RED-BLACK	DC 5V	Confirm steady voltage.
		CN6 1-4	WHITE-BLACK	DC 0.3~4.5V	Voltage changes according to the APS operation.
F	Flame Rod	CN2 1	BLACK	DC 10uA	Measure the current when the burner is operating.
	Ground Wire	CN2 2	GREEN-YELLOW		Check for properly grounded wire.
G	Gas Valve	CN16 1-2	RED-YELLOW	DC 22~24V	Confirm voltage as the Main Gas Valve 1 is operating.
		CN16 1-3	WHITE-RED	DC 22~24V	Confirm voltage as the Main Gas Valve 2 is operating.
H	Dual Venturi	CN15 1-4	BROWN-WHITE	ON : AC 95~120V OFF : 0V	Confirm voltage relative to operation.
		CN15 4-5	BLUE-WHITE	ON : AC 95~120V OFF : 0V	
I	3-Way Valve	CN14 1-2-3	BLACK-RED-BROWN	AC 97~138V	

Point	Function	CN No.	Wire Color	Normal Value	Check
J	Power Input	CN1 1-2	WHITE-BLACK	AC 97~138V	Confirm appropriate power source. Confirm the FUSE. Confirm the circuit breaker.
K	Igniter	CN17 1-2	BLUE-BLUE	ON : AC 97~138V OFF : 0V	Confirm voltage when the unit is igniting.
L	Pump	CN18 1-3	YELLOW-WHITE	ON : AC 96~138V OFF : 0V	Confirm voltage as operating.
M	Fan Motor	CN8 4-7	BLACK-RED	DC 127~184V	Confirm steady voltage.
		CN8 2-4	BLACK-YELLOW	DC 15V	Confirm steady voltage.
		CN8 3-4	BLACK-ORANGE	DC 0~7.5V	Voltage changes relative to fan operation.
		CN8 1-4	BLACK-WHITE	0~6500rpm	Check PULSE.
N	Auto Feeder Valve	CN21 1-2	PURPLE- PURPLE	ON: DC 22~24V OFF: 0V	
O	Front Panel Controller	CON1 1~14	All BLACK		

4.9 Key Components Description

4.9.1 PCB

Part	Check Point
Function	To control each component and also to check the overall performance of the unit.
Failure Event	Malfunctioning PCB.
Effects	A component may not operate within the unit and could produce an error code. In most cases of PCB failure, the whole unit will not operate until the problem is resolved.
Error Code	E515, E615
Diagnostic	Visual inspection: Connection and/or breakage of wires and/or burn marks on the PCB.
Color/Number of wires	Refer to page 56-59



4.9.2 High Limit Switch

Check Point	Check Point
Function	1. Overheat prevention switch. 2. If the unit detects extremely high temperatures, it will automatically trip and shut down the unit. 3. Excessively high water temperatures (more than 197.6 °F or 92 °C) in heat exchanger will activate the high limit switch.
Failure Event	Unable to detect excessively high water temperature if switch fails.
Effects	Unable to shut down the boiler if the water temperature from the heat exchanger exceeds 197.6°F (92°C).
Error Code	E016, E046
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Resistance check: Check range of resistance shown below.
Color/Number of wires	Resistance range : under 1.0 Ω

4.9.3 Thermistor

Part	Check Point
Function	Measure Hot water, Cold water, Space heating outlet and inlet temperatures in the boiler.
Failure Event	Unable to properly measure water temperature within the boiler.
Effects	1. If any of the thermistors fail, an error code appears before starting operation. 2. If resistance values are off, the boiler will produce temperature fluctuations in hot water.
Error Code	E047, E205, E218, E407, E421
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Check the resistance of the sensor (Stop operating and lower the temperature before checking).
Color/Number of wires	Resistance range : Please refer to the table below

Check if the hot water temperature sensor is open (Error type : MΩ Open)

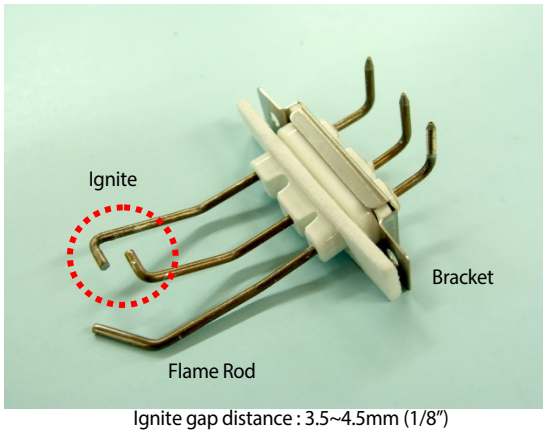
Temp(°F)	Thermistor (kΩ)	Exhaust Limit Temperature Sensor (kΩ)
32~40	17.9~25.4	113.6~180.7
40~50	14.5~20.3	89.2~139.5
50~60	11.4~16.4	67.5~108.5
60~70	9.4~12.8	51.5~81.1
70~80	7.5~10.4	41.5~61.3
80~90	6~8.2	32.2~48.9
90~100	5.1~6.6	26.3~37.6

4.9.4 Fan Motor

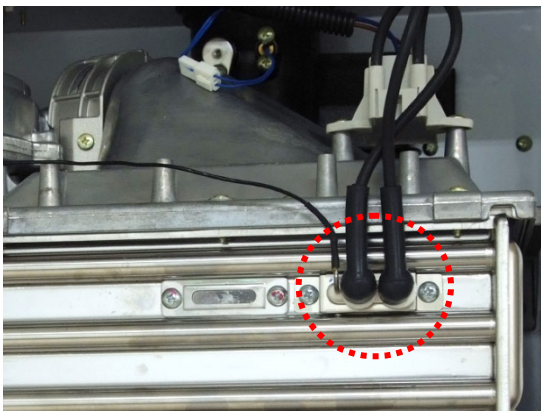
Part	Check Point
Function	To provide combustion air into the burner and to purge exhaust flue gas. To maintain the gas input with a long vent run, the fan operates with APS for ideal combustion.
Failure Event	1. Fan speed failure: the fan RPM is around 0 RPM. 2. The fan assembly screw is loose and/or the fan is disassembled. 3. Disconnected or defective fan connection terminal assembly.
Effects	1. Unstable combustion condition. 2. Unit vibrating and noise. 3. The boiler is not operating properly.
Error Code	E109, E110
Diagnostic	1. Visual inspection: check the fan connection wire and/or the fan mounting location. 2. Voltage check: Check range of voltage shown below.
Color/Number of wires	• Black-Red: DC 127V~184 V • Black-Yellow: DC 15 V • Black-Orange: DC 0~7.5 V • Black-White: 0 ~ 7,000 RPM

4.9.5 Flame Rod Assembly

Part	Check Point
Function	To ignite gas by repeatedly discharging a high voltage spark to the main burner until gas ignites.
Failure Event	1. Unable to ignite during the ignition process. 2. Produces multiple unsuccessful attempts to ignite.
Effects	1. The unit cannot ignite during the ignition process and “E003” or “E004” error codes will display. 2. Durability of the igniter wears down
Error Code	E003, E004, E012
Diagnostic	Visual inspection: Connection and/or breakage of wires.
Color/Number of wires	BLACK: 0~10 uA

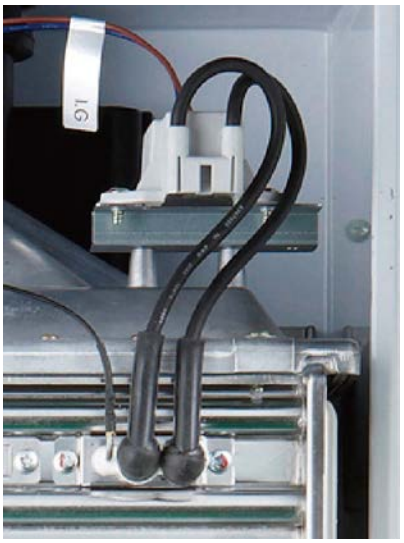


Ignite gap distance : 3.5~4.5mm (1/8”)

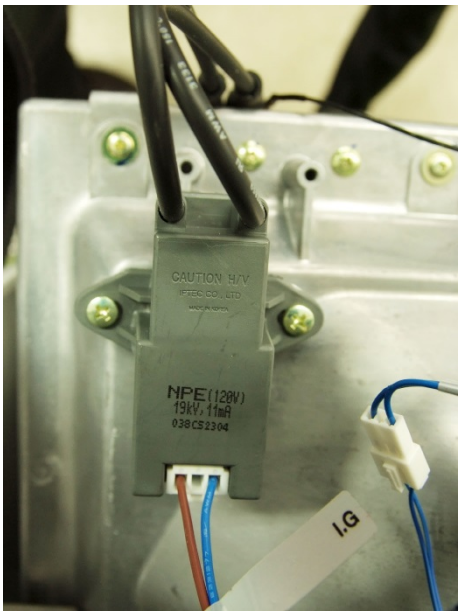


4.9.6 Ignition Transformer

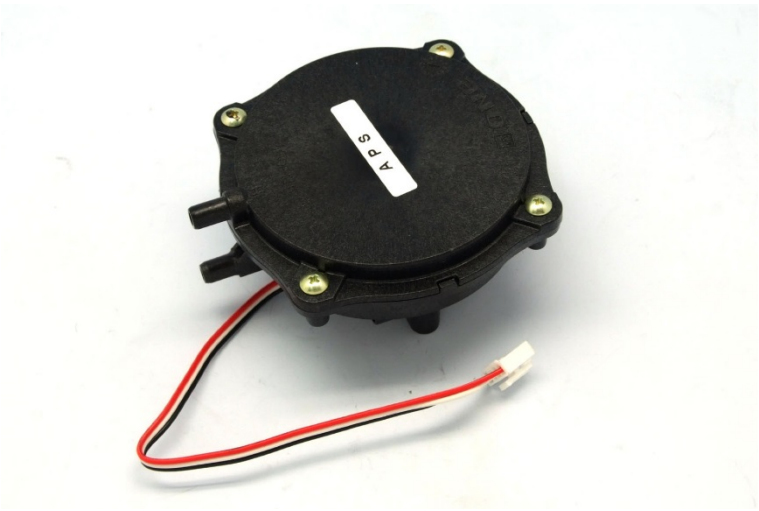
Part	Check Point
Function	To ignite gas by repeatedly discharging a high voltage spark to the main burner until gas ignites.
Failure Event	1. Unable to ignite during the ignition process. 2. Produces multiple unsuccessful attempts to ignite.
Effects	1. The unit cannot ignite during the ignition process and “E003” or “E004” error codes will display. 2. Durability of the igniter wears down.
Error Code	E003, E004
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Voltage check: Check range of voltage shown below.
Color/Number of wires	Blue • On : AC 97 ~ 138 V • Off : 0 V



Input Voltage	Output Voltage	Output Current
120 V, 60 Hz	20 KV±	10mA±2mA

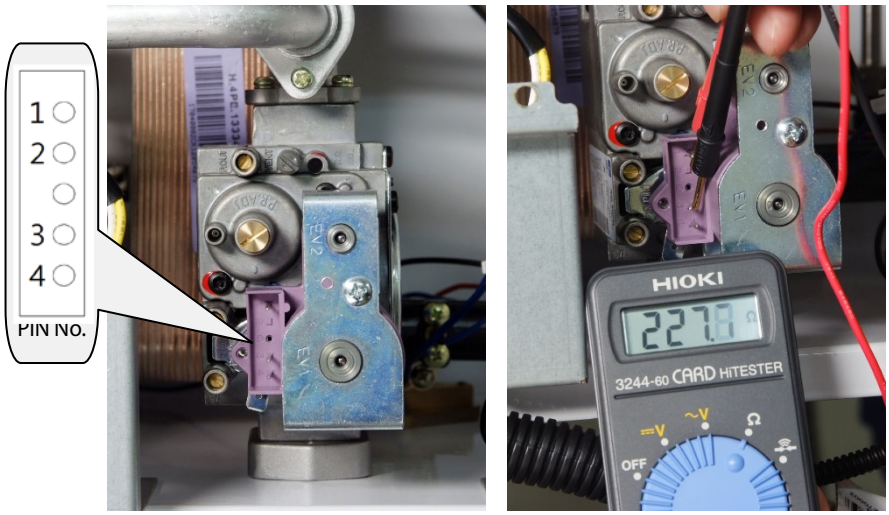


4.9.7 APS

Part	Check Point
Function	Detecting the air pressure entering the burner system.
Failure Event	1. Combustion noise occurs. 2. Imperfect and/or abnormal flame occurs. 3. Occurs when APS does not detect proper voltage.
Effects	1. The boiler is not operating. 2. Produces excessive carbon monoxide emissions.
Error Code	E110
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Voltage check: Check range of voltage shown below. 3. Check the exhaust duct for obstruction or blockages. 4. Check the condensate trap and drain piping for obstruction or blockages. 5. Check for decreased hot water output.
Color/Number of wires	• RED-BLACK: DC 5 V • WHITE-BLACK: DC 0.3 ~ 4.5 V
	

4.9.8 Main Gas Valve

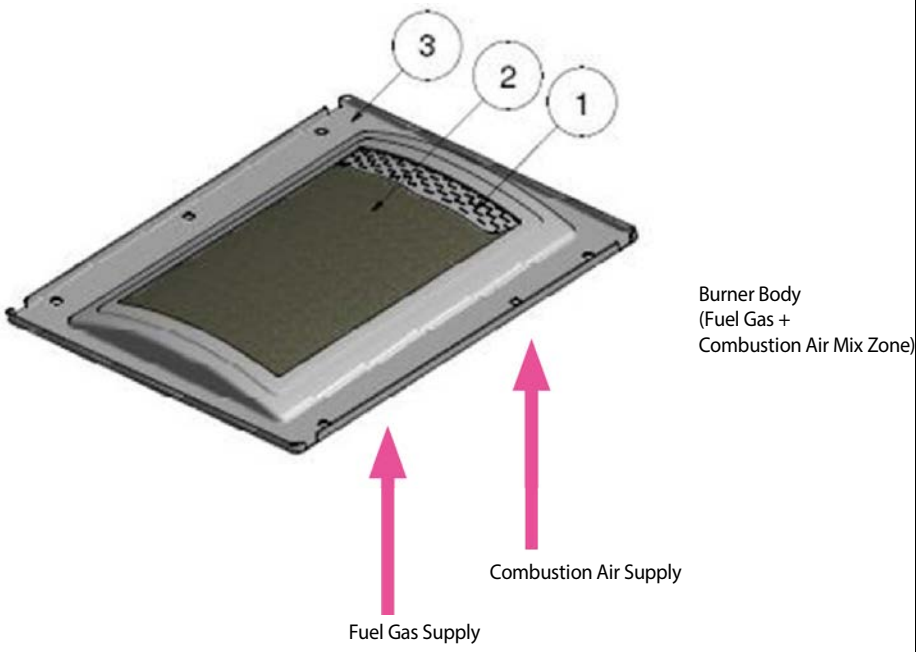
Part	Check Point
Function	1. To control the amount of gas supplied to the burner based on fan speed. 2. When the unit experiences abnormal combustion, it shuts off the gas valve automatically and prevents unsafe situations.
Failure Event	Unable to open/close
Effects	1. No flames. 2. No operation of the unit.
Error Code	E003, E012
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Check if the solenoid valve of Main Gas Valve works properly. • Resistance check : Check range of resistance shown below.
Color/Number of wires	• Connector Pin No. 1&3 : over 100-1000 Ω • Connector Pin No. 1&4 : over 100-1000 Ω



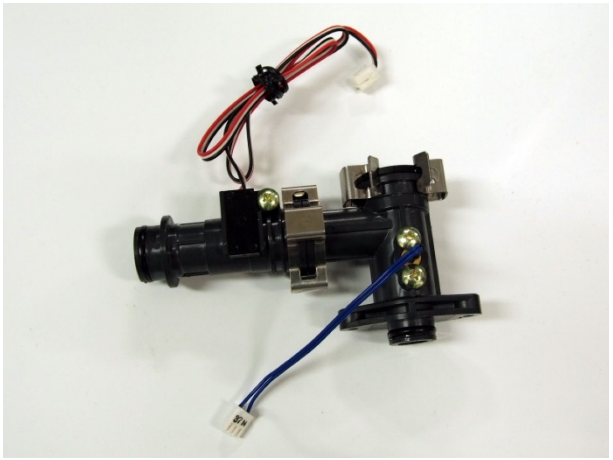
Resistance range : 100~1,000 Ω

4.9.9 Burner

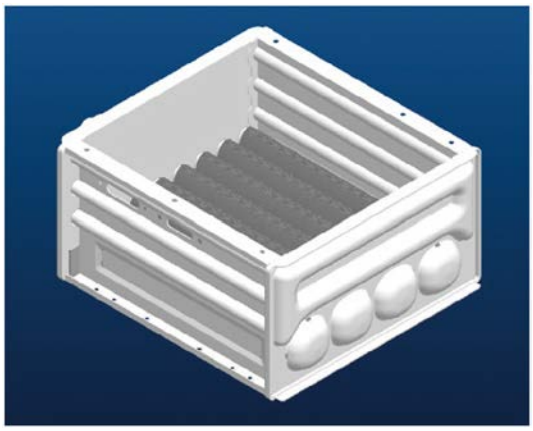
Part	Check Point
Function	1. Pre-Mix system reduces emissions and increase efficiency. 2. The burner facilitates the air/gas mixture necessary to produce the proper heat during combustion.
Failure Event	1. Unable to initialize/sustain combustion. 2. Dust or soot deposit on the burner surface 3. Possible gas leakage from burners.
Effects	1. Abnormal combustion. 2. Unstable flame conditions and/or flame loss. 3. Ignition failure.
Error Code	E003, E004, E012
Diagnostic	Visual inspection: Excessive deposits on the burner surface and/or unstable flame conditions during operation.



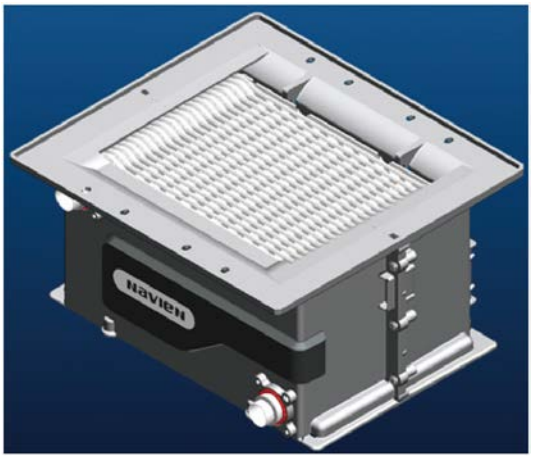
4.9.10 Flow Sensor

Part	Check Point
Function	To detect water flow in GPM (Gallons Per Minute) for steady hot water temperatures.
Failure Event	1. Unable to detect or measure water flow rate. 2. Damage to and/or water leakage from the water flow sensor.
Effects	1. Ignition sequence does not start. 2. Stop operating once detecting water leakage.
Error Code	E439
Diagnostic	1. Visual inspection: Connection and/or breakage of wires. 2. Visual Inspection: Check for damage and/or scale formation on sensor.
Color/Number of wires	• RED-BLACK: DC 12 V • WHITE-BLACK Start position: DC 0 V Any open position: DC 5 V • Blue-Brown: Pulse
	

4.9.11 Primary Heat Exchanger

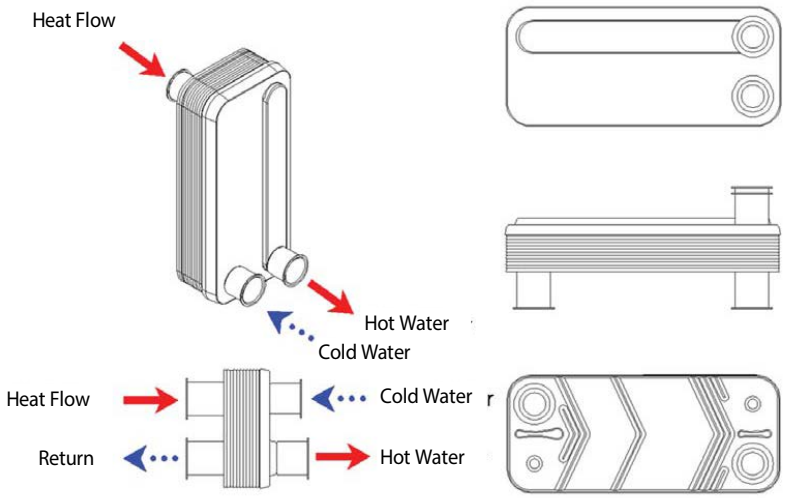
Part	Check Point
Function	1. Main part for heat transfer from the burner. 2. There are multiple paths of water pipes on the heat exchanger surface as well as inside the combustion chamber which minimizes the heat loss.
Failure Event	1. Water and/or exhaust gas leakage through a crack. 2. Improper heat transfer can cause the water in the heat exchanger to boil due to possible scale formation.
Effects	1. Exhaust gas leakage. 2. Excessive heating of the water that produces boiling noises.
Error Code	E016, E030, E047
Diagnostic	1. Visual inspection: Check if there is a crack on the surface of heat exchanger. 2. Sound inspection: Check if boiling occurs inside the unit.
	

4.9.12 Secondary Heat Exchanger

Part	Check Point
Function	1. Main part for heat transfer from the burner. 2. There are multiple paths of water pipes on the heat exchanger as well as inside the combustion chamber which minimizes heat loss.
Failure Event	1. Water and/or exhaust gas leakage through a crack. 2. Improper heat transfer can cause the water in heat exchanger to boil.
Effects	1. Exhaust gas leakage. 2. Excessive heating of the water that produces boiling noises.
Error Code	E016, E030, E047
Diagnostic	1. Visual inspection: Check if there is a crack on the surface of heat exchanger. 2. Sound inspection: Check if boiling occurs.
	

4.9.13 DHW Heat Exchanger

Part	Check Point
Function	Water heated in the primary/secondary heat exchanger is circulated to the plate heat exchanger, where the heat of heating water and tap water are exchanged so that hot water is available
Failure Event	1. Water leakage through a crack. 2. Improper heat transfer can cause the cold water in heat exchanger
Effects	Temperature fluctuations in the hot water outlet and/or leaking.
Error Code	E016, E030, E353
Diagnostic	The plate heat exchanger filters out impurities in space heating pipes to prevent heating problems caused by impurities. Leak in plate heat exchanger will cause pressure in space heating side to increase to tap water pressure level.



4.9.14 Circulation Pump

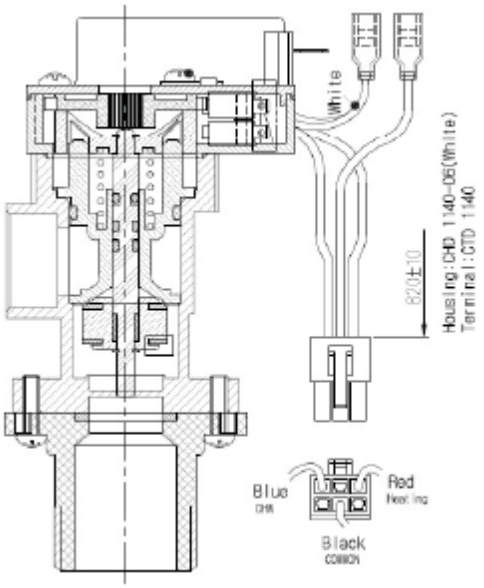
Part	Check Point
Function	1. Pump operates when using internal or external hot water circulation. 2. Internal circulation will minimize the effect of temperature fluctuations and external circulation delivers hot water to fixtures quickly resulting in water conservation.
Failure Event	Unable to detect or measure water flow rate when the pump is called to operate.
Effects	1. The boiler freezes. 2. Temperature fluctuations when the boiler is set to internal recirculation. 3. Hot water is not quickly available at fixtures when the boiler is set to external recirculation.
Error Code	-
Diagnostic	1. Visual inspection: Check the circulation pump connection wire. 2. * Check for blocked/clogged water filter. 3. Voltage check: Check range of voltage shown below.
Color/Number of wires	YELLOW-WHITE • ON : AC 96 ~138 V • OFF : 0V

<Circulation Pump>

<Air Vent>

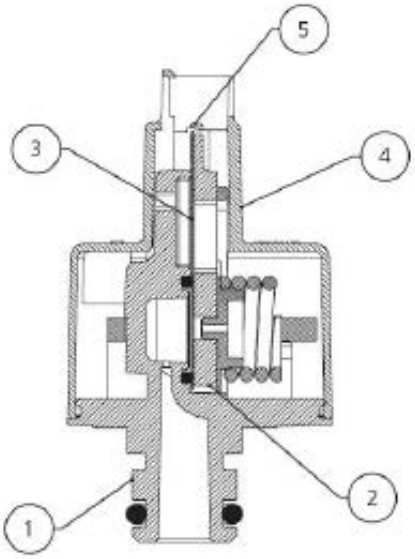
4.9.15 3-Way Valve

Part	Check Point
Function	Diverts the water from the space heating system to the DHW plate heat exchanger and back based on input from DHW flow sensor and PCB.
Failure Event	1. No hot water in space heating mode. 2. No domestic hot water in DHW mode.
Effects	In the case that the temperature of space heating is lower than the set temperature, it blocks the water flow path for domestic hot water so that heating water can flow through space heating pipes.
Error Code	E016
Diagnostic	1. Visual inspection: check the 3-Way Valve connection wire. 2. Voltage check: Check range of voltage shown below.
Color/Number of wires	Blue-Black : ON AC 97 ~ 138 V, OFF 0 V ※ Confirm voltage as the 3-Way Valve operating



4.9.16 Water Pressure Sensor

Part	Check Point
Function	They are suitable for analyzing water pressure ratios in heating.
Failure Event	Unable to detect or measure to change water pressure
Effects	Water filling system does not operate automatically
Error Code	E351, E352, E353
Diagnostic	1. Visual inspection: check the circulation pump connection wire. 2. Voltage check: Check range of voltage shown below.
Color/Number of wires	Black-Red : DC 0~5V

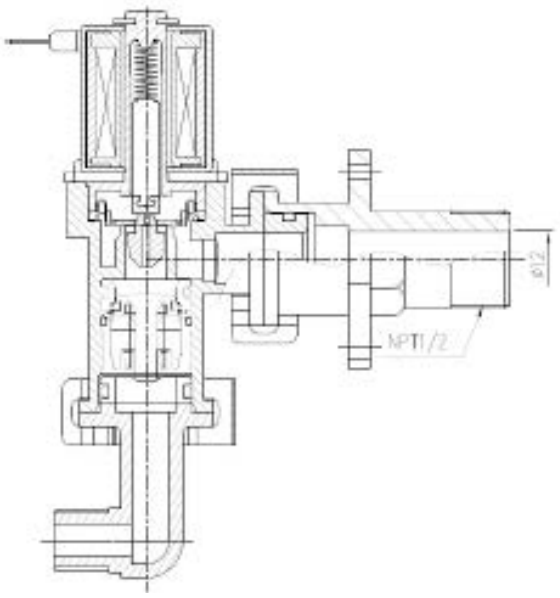


Legend to cross-section drawing
1. Pressure connection
2. Ceramic sensor
3. Amplifier electronics
4. Cover
5. Electrical connection (RAST 2.5)

4.9.17 Auto feeder Valve

Part	Check Point
Function	Detect low and high water pressure using the electronic water pressure sensor If water pressure is low, Water filling system operates automatically
Failure Event	1. Water filling system does not operate automatically. 2. Water filling system operates continuously.
Effects	1. System is low water pressure 2. If system is high water pressure for automatic filling, it is over flow
Error Code	E351, E352
Diagnostic	1. Visual inspection: check the Auto feeder valve connection wire. 2. Voltage check: Check range of voltage shown below.
Color/Number of wires	Blue-Blue : ON DC 22 ~ 24V, OFF 0 V

<Auto feeder valve>



5. Troubleshooting

5.1 Error code classification

Classification	Error Code	Error Level	Function	Self-diagnostic/Action
Combusition System	E003	3	Ignition failure	Manual RESET
	E004	2	False flame detection	Auto RESET
	E012	3	Flame loss	Manual RESET
	E016	3	Overheating of heat exchanger	Manual RESET
	E030	3 1	Exhaust Overheat: exhaust limit switch shuts down the unit when the flue temperature exceeds 230°F(110℃) for more than 10 seconds.	Manual RESET Auto RESET
	E046	2	Abnormal heat exchanger thermistor	Auto RESET
	E047	3 2	Abnormal exchaust thermistor	Manual RESET Auto RESET
	E060	1	Abnormal Dual Venturi Limit Switch	Auto RESET
Air supply System	E109	3	Abnormal FAN motor activity	Manual RESET
	E110	3	Exhaust blockage	Manual RESET
	-	-	Abnormal APS (open, short, initial value or no answer)	No error display
CH System	E205	2	Abnormal H/E outlet : thermistor open or short	Auto RESET
	E218	1	Abnormal H/E inlet : thermistor open or short	Alarm
Water supply System	-	-	Abnormal water pressure (Low pressure)	Auto Reset
	E351	3	Abnormal auto feeder valve	Manual RESET
	E352	2	Abnormal water pressure (High pressure)	Auto Reset
	E353	2	Abnormal water pressure sensor	Auto Reset
DHW System	E407	1	Hot water outlet1: thermistor open or short	Alarm
	E421	1	Cold water inlet1: thermistor open or short	Auto RESET
	E439	3	Abnormal flow sensor	Auto RESET
Controller	E515	3	Abnormal PCB	Manual RESET
	E517	3	Abnormal DIP Switch setting	Manual RESET
	E594	1	Abnormal communication in parts of PCB	Alarm
	E615	3	Abnormal input & memory	Manual RESET
Installation System	E740	2	Abnormal outdoor sensor	Auto RESET
	E782	1	Abnormal Main-Panel communication	Auto RESET
	E777	2	Abnormal LWCO	Auto RESET

5.2 Error Code List

Error Code	Function	Self-diagnostic/Action
E003	Ignition failure	1. Check to see if the main gas supply valve is open. 2. Check that the power is “ON”. 3. Check the igniter for spark. 4. Tighten the ground connection screws on heat exchanger.
E004	False flame detection	1. Ensure ground wire is connected. 2. Check the igniter for spark.
E012	Flame loss	1. Check the main gas line (Is the valve open?). 2. Check intake air filter. 3. Check ground wire. 4. Check power supply. 5. Tighten the ground connection screws on heat exchanger.
E016	Overheating of heat exchanger	1. Turn OFF the system for at least 30 minutes then restart. 2. Clean the inlet water filter. 3. Check the high limit switch 4. Check the water adjustment valve. 5. Check the heat exchanger; a flush may be necessary.
E030	Exhaust Overheat: exhaust limit switch shuts down the unit when the flue temperature exceeds 230 °F (110 °C) for more than 10 minutes.	1. Turn OFF the system for at least 30 minutes then restart. 2. Clean the inlet water filter. 3. Check the water adjustment valve. 4. Check the heat exchanger; a flush may be necessary.
E046	Abnormal heat exchanger thermistor	Check heat exchanger thermistor connection
E047	Abnormal exhaust thermistor	Check exhaust thermistor connection.
E060	Abnormal operation: dual venturi	Check the Dual Venturi connection.
E109	Abnormal fan motor activity	1. Check and clean the intake air filter. 2. Check and clean the fan motor.
E110	Exhaust blockage	1. Check the exhaust pipe for obstructions. 2. Check and clean the intake air filter
E205	Heating supply : thermistor open or short	1. Check the thermistor. 2. Check the pump connection and 고착
E218	Heating return : thermistor open or short	Check the thermistor.

Error Code	Function	Self-diagnostic/Action
E351	Abnormal Auto feeder valve (make-up water)	Check the auto feeder valve
E352	High water pressure	Check the auto feeder valve
E353	Abnormal operation: water pressure sensor	Check the water pressure sensor.
E407	Hot water outlet: thermistor open or short	1. Check the thermistor. 2. Replace the thermistor.
E421	Cold water inlet: thermistor open or short	1. Check the thermistor. 2. Replace the thermistor.
E515	Abnormal PCB	Check the PCB
E517	Abnormal dip switch setting	Check the dip switches on the front panel and PCB.
E594	Abnormal operation: EEPROM	Check the PCB
E615	Abnormal input & memory	Check the PCB.
E740	Abnormal operation: outdoor temperature sensor (appears only when the outdoor reset curve is enabled).	1. Ensure that the outdoor reset curve is configured properly. 2. Check the outdoor temperature sensor wiring connection.
E777	Abnormal operation: LWCO	1. Check the LWCO wiring connection 2. Ensure that the system water level is appropriate. 3. Add make-up water to the system if necessary.
E782	Abnormal Main-Panel communication	Check the PCB.

If any of the above solutions do not resolve the problem with the Boiler, contact Navien's Technical department at 1-800-519-8794.

There will be error codes displayed on the front panel and recorded on the PCB board (within the unit) of any problems or failures that occur with the Boiler.

IMPORTANT

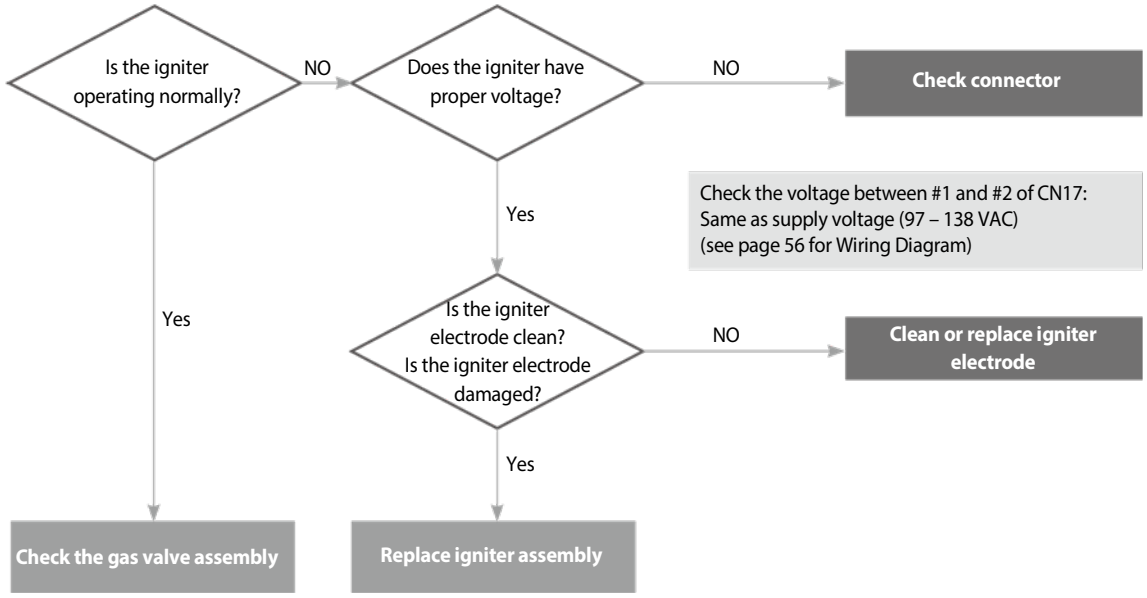
To reset the Boiler, either press the [Reset] button on the front panel or disconnect, then reconnect electrical power to the boiler.

5.2.1 003Error

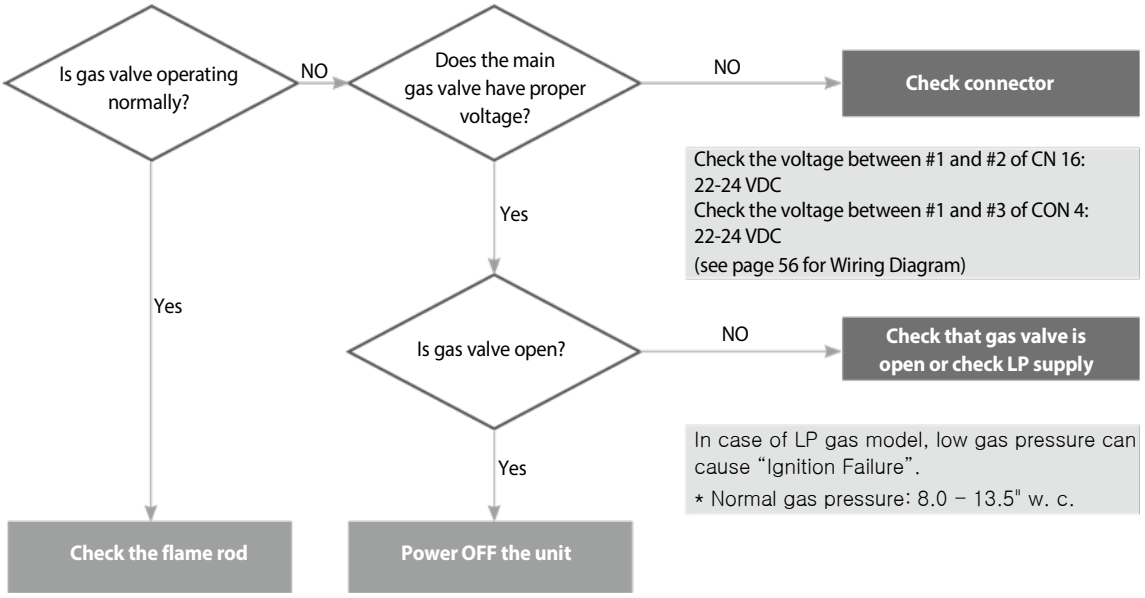
Error occurrence conditions and check items

Error	Description
E003 Ignition failure	In the case of an ignition failure, the boiler will attempt ignition 10 times. If no flame is detected, the system displays the error message 003E (manually cleared) on the Front Panel.
Check items	1. Check if the gas supply valve is open and for proper supply pressure. 2. Check the electrode gap, electricity discharge, or deformation of the flame rod. 3. Check the operation of the ignition transformer (ignition state, input power (AC 102~132 V) 4. Check the operation of the gas control valve (DC 22~24 V, coil short circuit, solenoid valve). 5. Check the flame rod, wiring and grounding. 6. Check if the air pressure hose is broken or clogged. 7. Check if the air pressure sensor works properly. 8. Check the PCB DIP switch settings. 9. Adjust the offset pressure (see page 30). 10. Check the gas orifice plate for the proper gas type. 11. Check the flue and air supply for any collected water (for vertical vent installations). 12. Tighten the ground connection screws on heat exchanger. 13. If the issues continue despite checking the items above, replace the PCB.

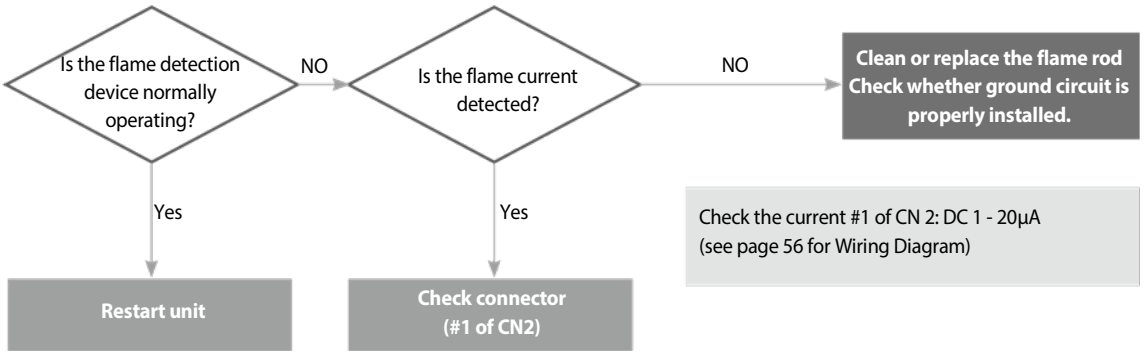
Scenario1



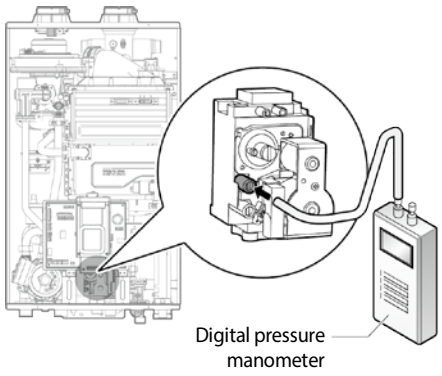
Scenario2

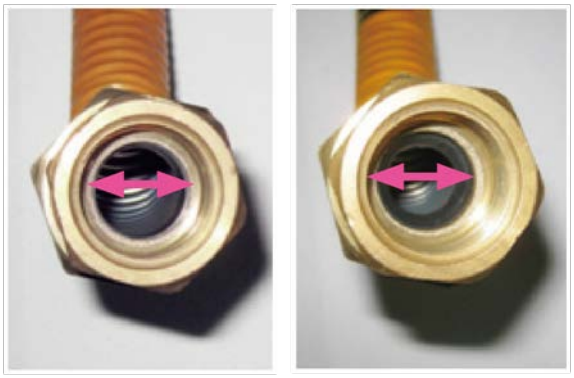

Is gas valve operating normally?
NO
Does the main gas valve have proper voltage?
NO
Check connector
Check the voltage between #1 and #2 of CN 16: 22-24 VDC
Check the voltage between #1 and #3 of CON 4: 22-24 VDC
(see page 56 for Wiring Diagram)
Yes
Yes
Is gas valve open?
NO
Check that gas valve is open or check LP supply
In case of LP gas model, low gas pressure can cause "Ignition Failure".
* Normal gas pressure: 8.0 – 13.5" w. c.
Yes
Check the flame rod
Power OFF the unit

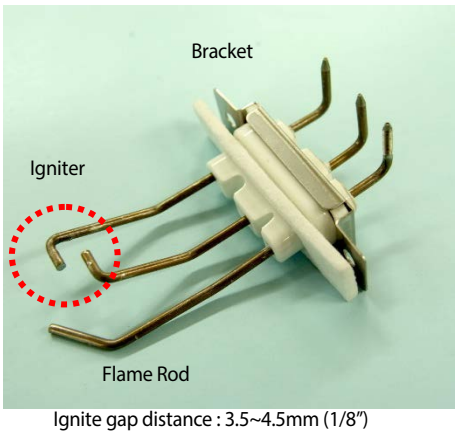
Scenario3

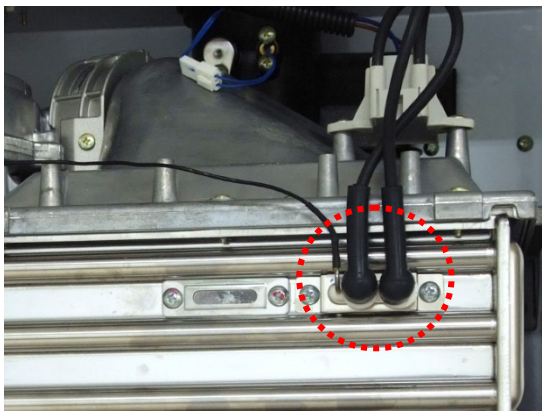
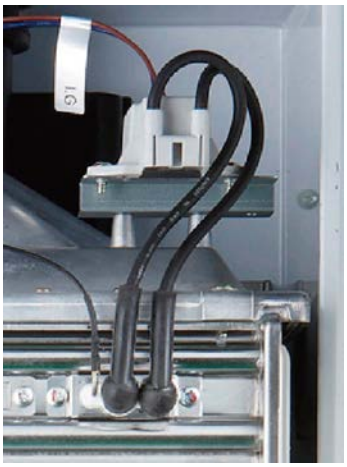

Is the flame detection device normally operating?
NO
Is the flame current detected?
NO
Clean or replace the flame rod
Check whether ground circuit is properly installed.
Check the current #1 of CN 2: DC 1 - 20μA
(see page 56 for Wiring Diagram)
Yes
Yes
Restart unit
Check connector (#1 of CN2)

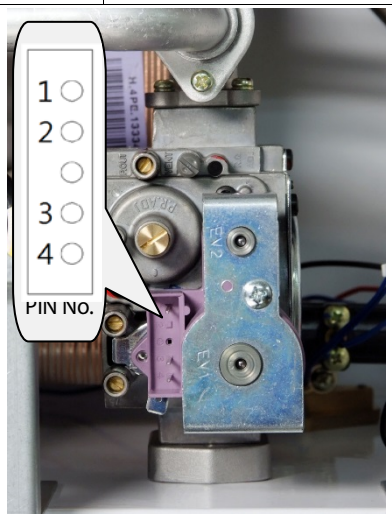
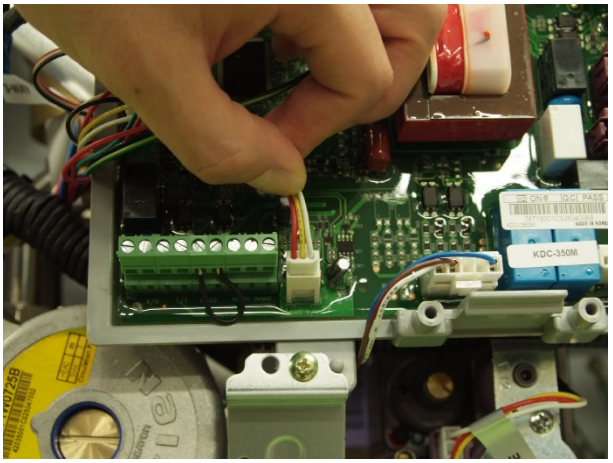
Check method

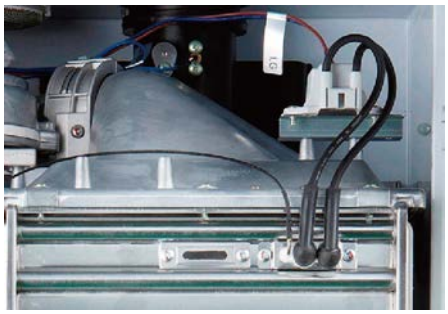
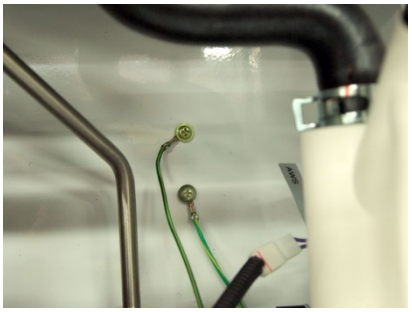
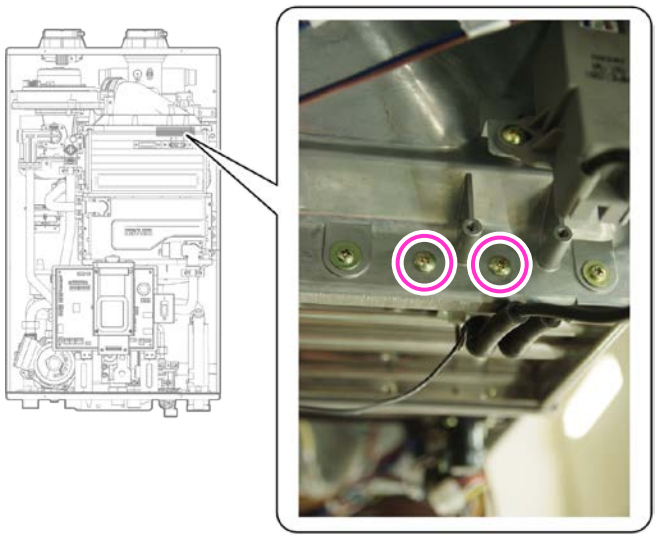
<table>
<tr><th>Failure mode</th><th>Cause</th><th>Check method</th></tr>
<tr><td rowspan="3">Ignition failure</td><td>Gas supply error</td><td>1. Check if the main gas valve is open.
2. Check the gas supply pressure.
• NG: 3.5” - 10.5” W.C, LP: 8” – 13.5” W.C
• LP pressure drop occurs frequently in the winter.
3. Check the flexible pipe diameter for compatibility with the boiler.
4. While the static pressure is normal, the use of another gas appliance may cause a possible drop in gas pressure to the unit. Therefore, it is required to check the dynamic pressure.
• Static pressure: Gas pressure during stand by.
• Dynamic pressure: Gas pressure at max combustion. (2nd stage MAX combustion setting: DIP S/W 1-1 ON)
5. If a CSST connector has been used, check to ensure that it is not been overtightened resulting in the seal obstructing gas flow.
6. Check the meter class (Example)
• Gas meter Boiler Furnace Domestic gas stove
• 425 CFH (Gas Meter) ≥ 195 CFH (Boiler)+ 58.8 CFH (Furnace) + 63.7 CFH (Domestic gas stove)
CFH = 1,020 Btuh</td></tr>
<tr><td colspan="2"> 

Check gas supply pressure(Refer to page 23)
 
A shifted seal narrows the inner diameter of CSST connector</td></tr>
<tr><td>Defective electrode gap and shape</td><td>Defective electrode gap and shape disables ignition.
• Appropriate electrode gap: approx. 3~4mm(1/8") (replace if defective)
• An ignition fail may occur due to improper gap, while discharge seems normal when checked via the flame monitoring window. Therefore, it is required to check the gap after disassembly.</td></tr>
</table>

<table>
<tr><th>Failure mode</th><th>Cause</th><th>Check method</th></tr>
<tr><td rowspan="3">Ignition failure</td><td colspan="2"> 


Ignite gap distance : 3.5~4.5mm (1/8")</td></tr>
<tr><td>No spark from electrode</td><td>When no spark is made from the electrode at ignition:
Remove the electrode and check if there is a crack on the insulator.
Adjust the gap if there is a discharge of electricity from the metallic part of the burner.
Ensure that the insulating gasket is installed between the electrode and burner casing.
Check the input power to the ignition transformer (AC 96 ~ 138 V).
If there is sufficient power to the ignition transformer, replace the ignition transformer.
Replace the PCB if there is no power or insufficient power supplied to the ignition transformer.
Check the insulator boots on the spark wires for cracks/holes.</td></tr>
<tr><td colspan="2"> 
Ignition transformer</td></tr>
</table>

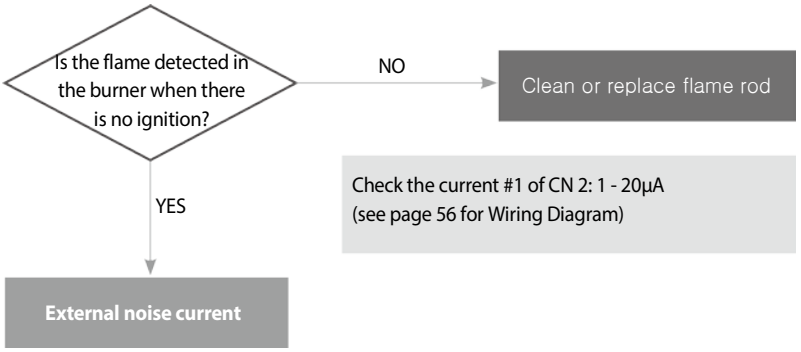
Failure mode	Cause	Check method
Ignition failure	Main gas valve	1. Check the primary/secondary power supply to the main gas valve. • Check, with a multi-meter, if the input power is DC 22-24 V. 2. Replace the PCB if power is not supplied. 3. If power supply is normal, check if the coil is open. • Check the resistance. (refer to page 125) 4. Check if the solenoid valve works properly. • Feel or hear a click.
	 Check if the coil is open (Proper resistance range : 100~1,000 Ω)  Check the voltage of the solenoid valve / White-Yellow, White-Red	

<table>
<tr><th>Failure mode</th><th>Cause</th><th>Check method</th></tr>
<tr><td rowspan="2">Repeated ignition-out</td><td>Flame sensing error</td><td>1. Check the location of the flame, if there is any deformation or foreign substance, repair or replace the part.
2. Check the flame rod wire for proper connection and/or damage.
3. Check the grounding to the boiler case to verify proper grounding at the outlet.
• If the ground wire is improperly connected or not making a good connection, remove and reattach the ground wire ensuring good contact with the case.
• Or use a multi-meter to measure the flame sensing current (normally 3~4 μA).</td></tr>
<tr><td colspan="2"> 
Measuring flame current
 
Grounding wire position</td></tr>
<tr><td>Flame loss and noise occurs at ignition</td><td>Check if there are any blockages in the gas orifice plate.</td><td>Ignition failure will occur if the gas orifices are clogged.
• Remove the gas inlet pipe and check the orifice plate.</td></tr>
<tr><td>Improper air intake air supply</td><td>Rainwater intrusion</td><td>Check if rainwater has collected inside the unit from an improperly installed air intake pipe.</td></tr>
<tr><td rowspan="2">Other trouble</td><td>Screw loosening</td><td>Tighten the ground connection screws on heat exchanger.
  </td></tr>
<tr><td>Defective PCB</td><td>If the issue continues despite checking above items, replace the PCB.</td></tr>
</table>

5.2.2 004Error

Error occurrence conditions and check items

Error	Description
E004 False-flame detection	1. Pre ignition false-flame If a flame signal is detected continuously for 3 seconds before combustion (stand-by, pre-purge, pre-ignition), a false-flame error 004E (automatically cleared) is displayed on the front panel and the system performs continuous post-purge and operates the pump. 2. Post purge false-flame If a flame signal is detected continuously for 3 seconds when the system performs post-purge as fuel supply is stopped, a false-flame error 004E (automatically cleared) is displayed on the front panel and the system performs continuous post-purge and operates the pump.
Check items	1. Check if gas leaks due to defective seals on the main gas valve. 2. Check if proper spark is discharged from the electrode. 3. Check if gas is supplied within the proper pressure range. 4. Check the PCB and replace if defective.

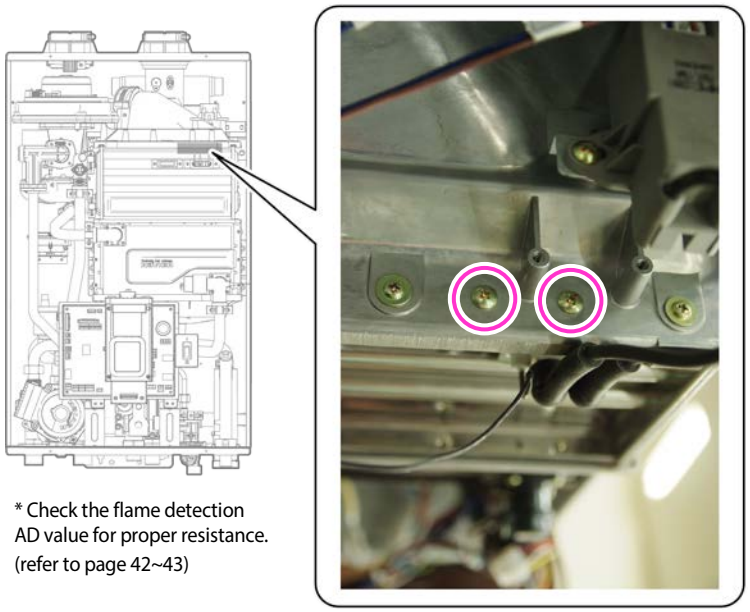

Is the flame detected in the burner when there is no ignition?
NO
Clean or replace flame rod
YES
Check the current #1 of CN 2: 1 - 20μA
(see page 56 for Wiring Diagram)
External noise current

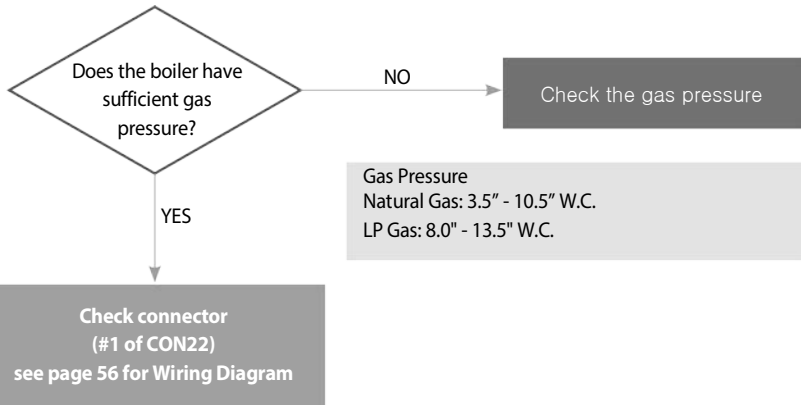
Check method

Failure mode	Cause	Check method
Flame before/after combustion	Leakage from main gas valve	Replace the gas flame if flame occurs before combustion or if there is remaining flame after combustion is stopped.
Error before/after combustion	Discharge of electricity from electrode	Spark discharges from electrode to flame sensor at ignition. • Replace or correct location of flame detecting rod.
	Gas valve	Gas may leak as the main gas valve is pushed by the gas supply over the standard pressure. • Check the supply pressure: NG: 3.5" ~ 10.5" WC, LP: 8.0" ~ 13.0"W.C • If the gas pressure is too high, notify the gas supplier about the issue, and if necessary, replace the gas valve. • If there is a gas leak close the gas supply valve and repair the unit before using the system.
Other trouble	Defective PCB	If the issue continues despite the checking of items above, replace the PCB.

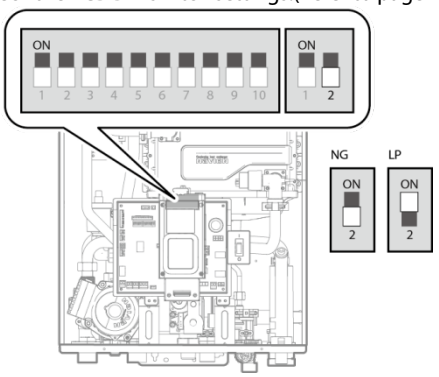
5.2.3 012Error

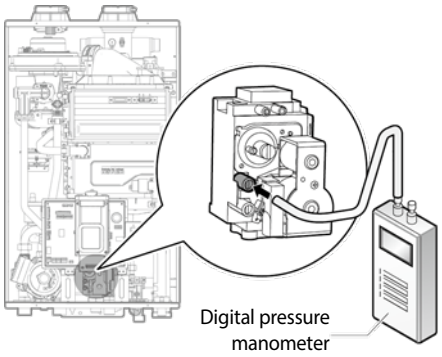
Error occurrence conditions and check items

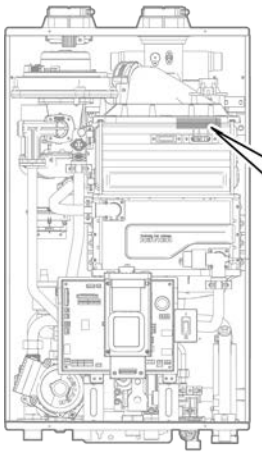
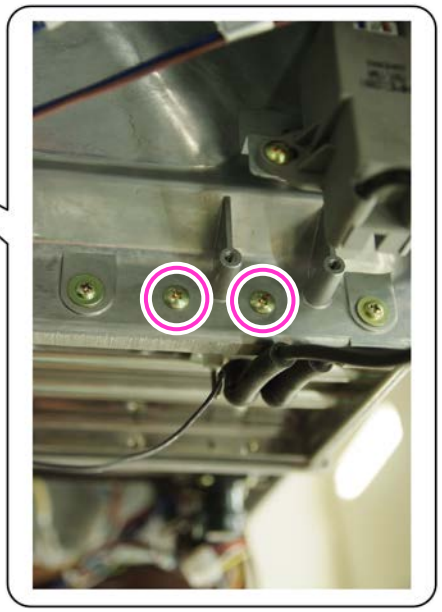
Error	Description
E012 Flame loss	If the system detects loss of flame during combustion, the system stops supplying fuel, attempts to restart, counts the incidents of flame loss, and if the incident occurs 20 times consecutively displays 012E (manually cleared) on the front panel.
Check items	1. Measure, with a manometer the gas supply pressure (NG: 3.5" ~ 10.5" W.C, LP: 8"~ 13.5" W.C) 2. Check the Gas meter Capacity. 3. Tighten the ground connection screws on heat exchanger.  * Check the flame detection AD value for proper resistance. (refer to page 42~43) 4. Check if the gas orifice is clogged. 5. Check if the PCB is working properly.



Check method

Fault	Possible Causes	Check method
Flame loss and noise occurs after ignition	Low gas supply pressure	1. Check the gas supply pressure. • NG: 3.5" - 10.5" W.C, LP: 8" - 13.5" W.C • LP pressure drop occurs frequently in the winter. 2. While the static pressure is normal, the use of another gas appliance may cause a possible drop in gas pressure to the unit. Therefore, it is required to check the dynamic pressure. Check the static pressure: Gas supply pressure during stand by. Check the dynamic pressure: Gas supply pressure at (2nd stage MAX combustion setting: DIP S/W 1-1 ON) MAX combustion 3. Check the gas pipe connector. • If a CSST connector has been used, check to ensure that it is not been overtightened resulting in the seal obstructing gas flow. 4. Check the gas meter capacity (Example) • Gas meter Boiler Furnace Domestic gas stove 425 CFH (Gas Meter) ≥ 195 CFH (Boiler)+ 58.8 CFH (Furnace) + 63.7 CFH (Domestic gas stove) CFH = 1,020 Btuh
Flame loss and noise occurs after ignition	PCB DIP switch setting error	Check the PCB DIP switch settings.(Refer to page 21) 
	Offset pressure adjustment error	Low fire (1-stage Min) offset adjustment error • Use the Front Panel to set the unit at "MIN.1" (refer to page 54). • Open the offset pressure port on the gas valve and connect a manometer. Use the positive pressure side on a dual port manometer. • Adjust the offset pressure by turning the adjustment screw on the gas valve with a 5/32" or 4mm Allen wrench, if the pressure value is out of range.

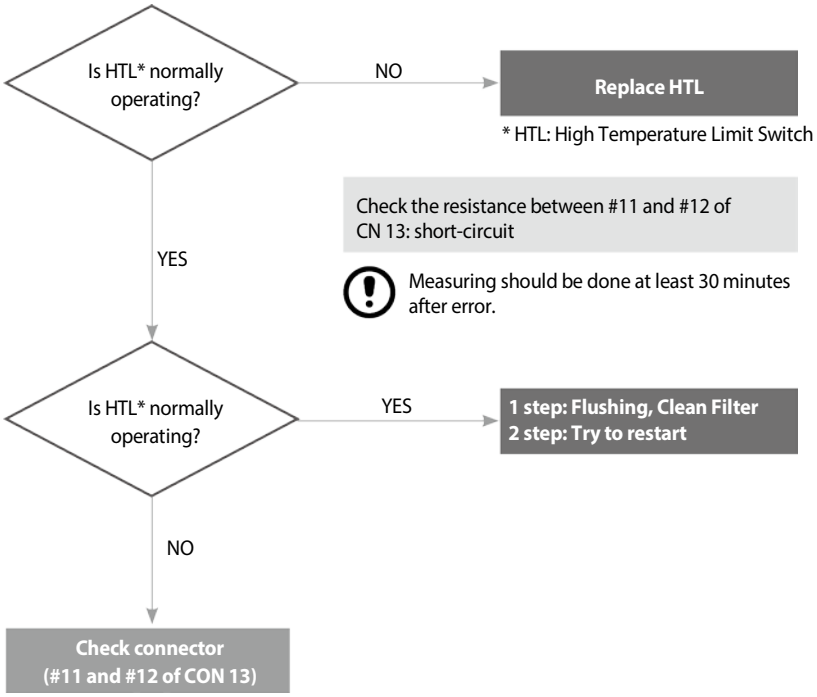
<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td>Flame loss and noise occurs after ignition</td><td colspan="2">


Check the offset values for low fire
<table>
<tr><th>Model</th><th>Gas Type</th><th>Offset</th></tr>
<tr><td rowspan="2">NCB-180</td><td>NG</td><td>-0.04"±0.01"</td></tr>
<tr><td>LP</td><td>-0.03"±0.01"</td></tr>
<tr><td rowspan="2">NCB-210</td><td>NG</td><td>-0.04"±0.01"</td></tr>
<tr><td>LP</td><td>-0.02"±0.01"</td></tr>
<tr><td rowspan="2">NCB-240</td><td>NG</td><td>-0.04"±0.01"</td></tr>
<tr><td>LP</td><td>-0.02"±0.01"</td></tr>
</table>
Offset value for low fire
</td></tr>
<tr><td>Flame loss during 2nd stage</td><td>Blockage in the gas orifice plate.</td><td>Flame loss will occur if the gas orifices are clogged.
• Remove the gas inlet pipe and check for debris; remove and clean the orifice plate if necessary.</td></tr>
<tr><td rowspan="2">Other trouble</td><td>PCB DIP switch setting error</td><td>Check the PCB DIP switch settings.(Refer to page 19)

* Check the flame detection AD value for proper resistance.
(refer to page 42~43)
 </td></tr>
<tr><td>Defective PCB</td><td>If the issue continues despite checking above items, replace the PCB.</td></tr>
</table>

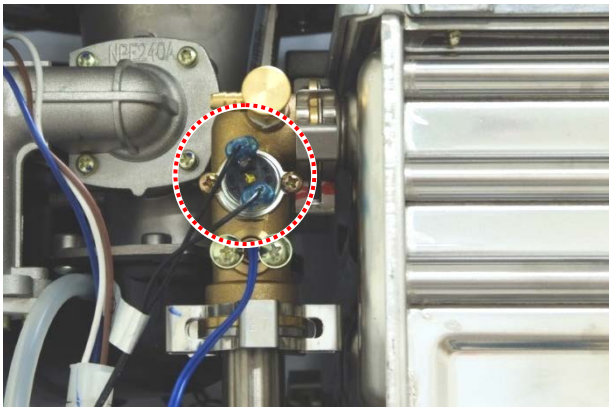
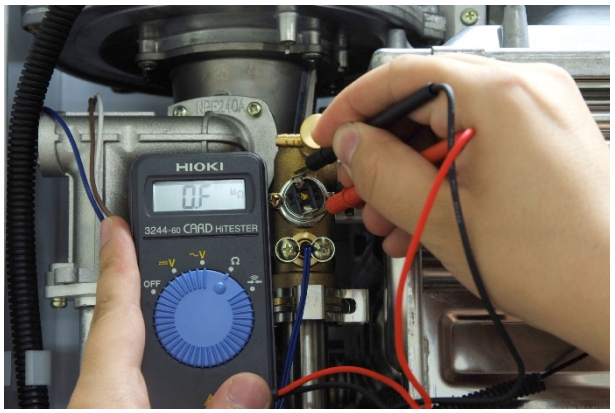
5.2.4 016Error

Error occurrence conditions and check items

Error	Description
E016 Bimetal overheated	If the overheat controller on the heat exchanger is initiated during combustion/standby of the boiler, the system displays the 016E (manually cleared) message on the front panel. The boiler switches into Lock-Out, and performs post-purge continuously and operates the pump.
Check items	1. Check if the overheat controller is working properly. * Check resistance value or continuity. (refer to page 61) 2. Check the hot water temperature sensor. (refer to page 62)


Is HTL* normally operating?
NO
Replace HTL
* HTL: High Temperature Limit Switch
Check the resistance between #11 and #12 of CN 13: short-circuit
Measuring should be done at least 30 minutes after error.
YES
Is HTL* normally operating?
YES
1 step: Flushing, Clean Filter
2 step: Try to restart
NO
Check connector (#11 and #12 of CON 13)

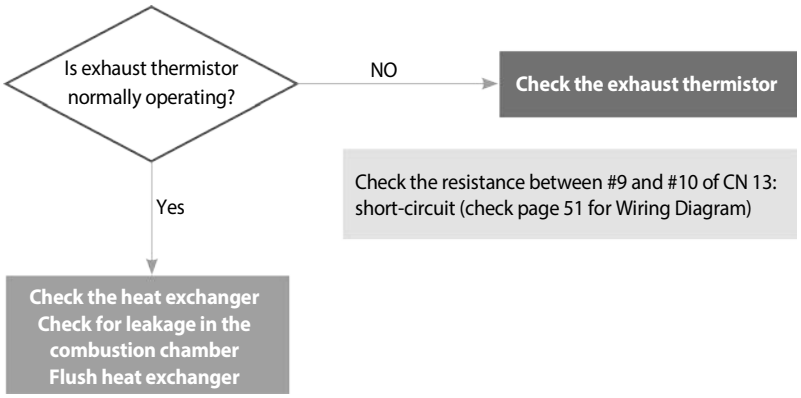
Check method

<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td rowspan="2">Defective safety device</td><td>Defective overheat controller</td><td>Check if the contact point of the overheat controller is defective.
• Use a multi-meter to see if the resistance is normal (0.3Ω) or abnormal (∞).</td></tr>
<tr><td colspan="2"> 
Overheat controller
 
Check if the overheat controller wire is disconnected (Normal resistance : 0.3Ω)</td></tr>
<tr><td>Temperature sensor error</td><td>Defective hot water output temperature sensor</td><td>1. If the hot water temperature is sensed lower than it actually is due to a defective sensor, check if the deviation of temperature is large due to a defective temperature sensor.
• Check the output temperature displayed on the front panel.
2. Measure the temperature sensor resistance, and determine if the sensor is defective.</td></tr>
<tr><td rowspan="3">Other potential issues</td><td>Capacity setting</td><td>1. If the Max switch #1 of 1-1 is on,
Set the switch to the normal operation position.
2. PCB DIP S/W capacity setting error can suddenly increase the hot water temperature.</td></tr>
<tr><td>Primary heat exchanger overheated</td><td>The surface temperature rises due to heavy scale deposits in the primary heat exchanger.
• Flush the primary heat exchanger.</td></tr>
<tr><td>Defective PCB</td><td>If the issue continues despite checking the items above, the PCB is defective.</td></tr>
</table>

5.2.5 030Error

Error occurrence conditions and check items

Error	Description
E030 Exhaust gas temperature error	If the overheat controller on the top of the exhaust duct is initiated, the system displays the heat exchanger bimetal overheat message 030E (cleared manually) on the front panel. The boiler switches into Lock-Out, and performs post-purge continuously and operates the pump. Overheating controller operates when the temperature exceeds 230°F (110°C) for 10 minutes or over. 1. When the controller detects the exceeding temperature of 230°F (110°C) for 10 minutes or over, "E030" error code will display and perform post-purge. ⟶ Automatically cleared. 2. When the controller detects the exceeding temperature of 140°F (60°C) while performing post-purge. ⟶ Manually cleared. 3. When the controller detects the exceeding temperature of 230°F (110°C) for 10 seconds or over three times or more after the error is automatically cleared. ⟶ Manually cleared.
Check items	1. Check if the overheat controller operates normally. 2. Check if the PCB works properly.

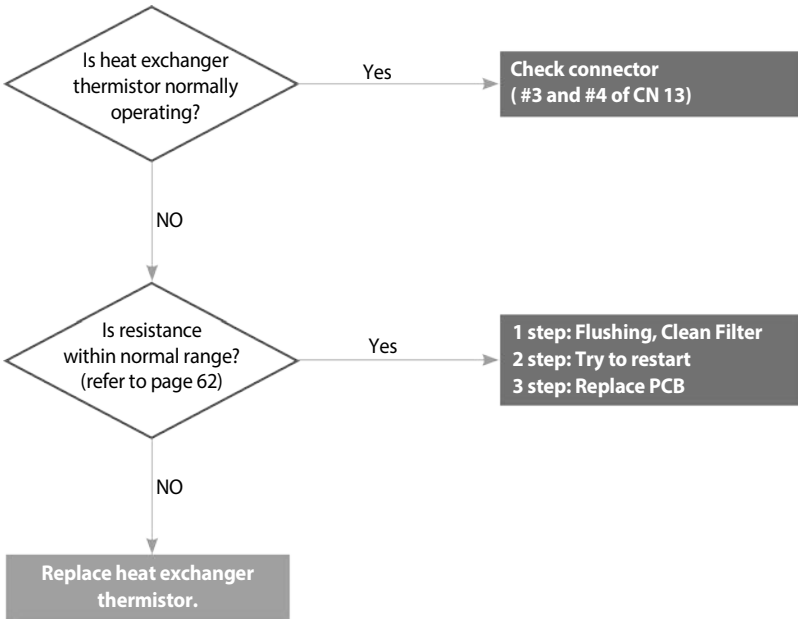

Is exhaust thermistor normally operating?
NO
Check the exhaust thermistor
Check the resistance between #9 and #10 of CN 13: short-circuit (check page 51 for Wiring Diagram)
Yes
Check the heat exchanger
Check for leakage in the combustion chamber
Flush heat exchanger

Check method

Fault	Possible Causes	Check method
Heat exchanger overheated	Damaged or clogged heat exchanger	1. The error occurs due to high exhaust gas temperature caused by a damaged or clogged heat exchanger. 2. Flush the heat exchanger to remove scale deposits. 3. Replace the heat exchanger if it is damaged or cannot be unclogged.
Defective part	Defective overheat controller	Defective contact point of the exhaust gas overheat controller 230°F (110°C) Max • Check connection of the overheat controller. • If the resistance is abnormal, replace the temperature sensor. (refer to page 62) • Check the output temperature displayed on the PCB.
	 Check if the hot water temperature sensor is open (Error type : MΩ Open)	
Other trouble	Defective PCB	If the issue continues despite checking the items above, replace the PCB.

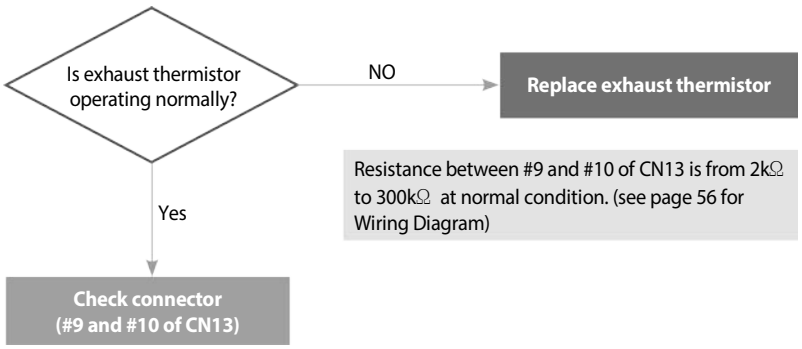
5.2.6 046Error

Error occurrence conditions and check items


Is heat exchanger thermistor normally operating?
Yes
Check connector (#3 and #4 of CN 13)
NO
Is resistance within normal range? (refer to page 62)
Yes
1 step: Flushing, Clean Filter
2 step: Try to restart
3 step: Replace PCB
NO
Replace heat exchanger thermistor.

5.2.7 047Error

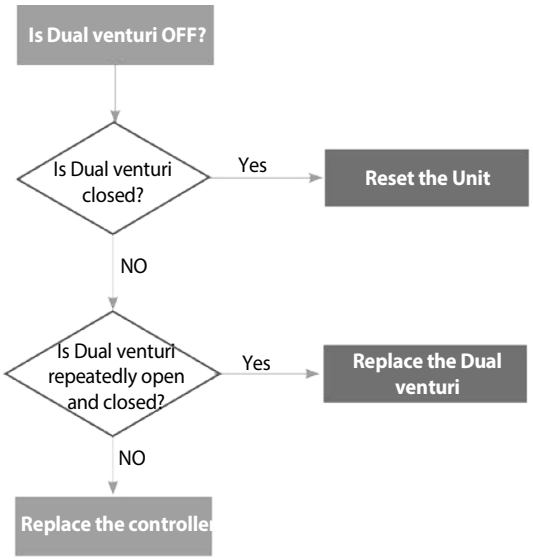
Error occurrence conditions and check items


Is exhaust thermistor operating normally?
NO
Replace exhaust thermistor
Resistance between #9 and #10 of CN13 is from 2kΩ to 300kΩ at normal condition. (see page 56 for Wiring Diagram)
Yes
Check connector (#9 and #10 of CN13)

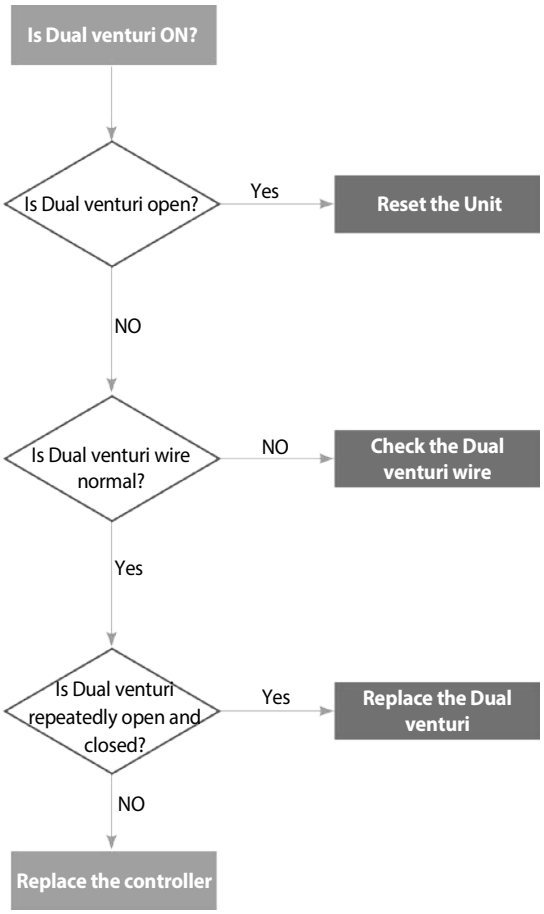
5.2.8 060Error

Error occurrence conditions and check items

Error	Description
E060 Dual Venturi error	This error message is displayed on the front panel if the wiring is disconnected or the Dual Venturi malfunctions. The boiler switches into Lock-Out, and performs post-purge continuously and operates the pump.
Check items	1. Check that the Dual Venturi is operating correctly. 2. Check that the wiring harness is connected correctly and the cables are not damaged.



Dual venturi OFF



Dual venturi ON

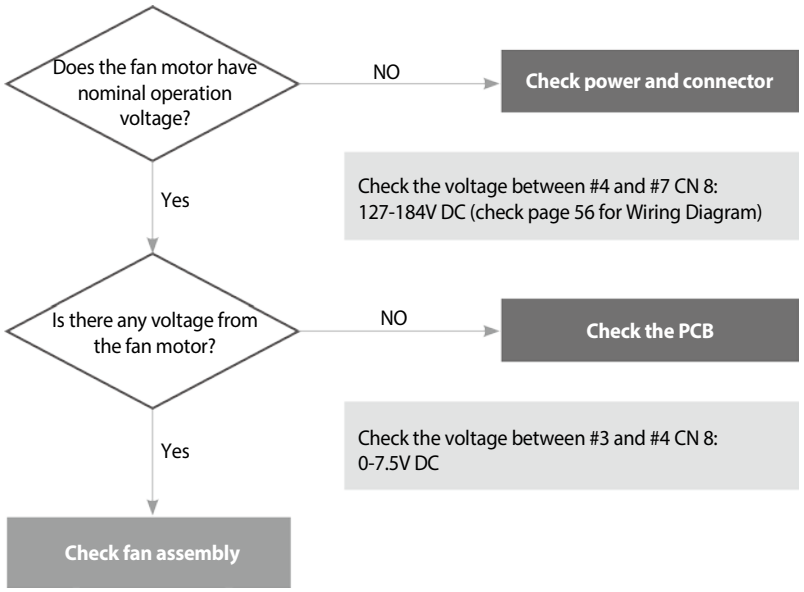
Check method

Fault	Possible Causes	Check method
Dual Venturi action error	Defective Dual Venturi cable or harness	1. Disconnect all cables from the Dual Venturi. 2. Using a multi-meter, test the Dual Venturi electrical wiring.
	Dual Venturi not operating	1. Turn off the power to the unit using the main power switch (do not use the front panel power button) and wait for 10 seconds. 2. Turn on the power. 3. Wait until Fan Auto Adjusting is complete. 4. Enter the Dual Venturi Test Mode and perform a test. 1) Repeat the test at least twice. Turning the unit ON and OFF once makes one test cycle. ON ⟶ OFF ⟶ ON ⟶ OFF ⟶ …… is the minimum sequence. 2) Confirm that the Dual Venturi is operating correctly. a. Listen to the Dual Venturi while it is running and check for operational noise (clicks at unit ON and unit OFF). b. If operational noise cannot be heard because of ambient noise, disassemble the Dual Venturi and perform a visual inspection. 5. If error message (E060) occurs, replace the Dual Venturi. 6. If a Dual Venturi error does not occur, replace the APS.

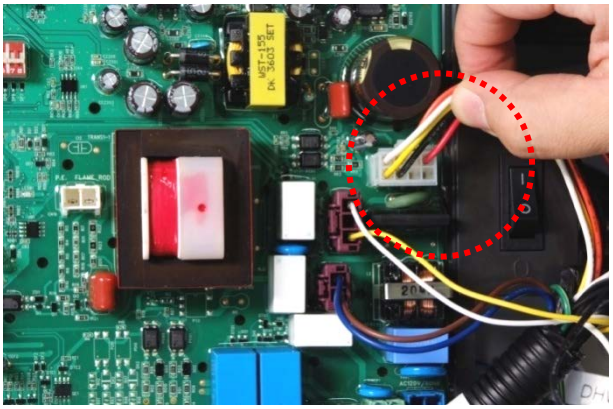
5.2.9 109Error

Error occurrence conditions and check items

Error	Description
E109 Fan motor RPM error	The system checks the RPM signal after the fan starts to run, and displays the error message 109E (cleared manually) in the following cases: 1. If the RPM remains low or close to 0, the system determines RPM error, and the boiler switches into Lock-Out (gas valve and ignition transformer locked). (However, the air pressure sensor should be normal.) 2. If the RPM signal of low or close to 0, is detected for 3 seconds during combustion, the system stops combustion, and the boiler switches into Lock-Out. (However, the air volume sensor should be normal.)
Check items	1. Check if the fan motor works normally using the component test mode (refer to page 21). 2. Check the power supply to the fan (Black + Red, approx. DC 127~184 V) 3. If RPM is significantly low while the fan works and the power supply is normal, replace the fan motor. 4. If the fan connector is wet due to any reason including leakage, take corrective action by powering the unit OFF, then drying the components completely before continuing operation. 5. Check for loose connection of white connector that attaches the fan motor to the PCB.


Does the fan motor have nominal operation voltage?
NO
Check power and connector
Yes
Check the voltage between #4 and #7 CN 8:
127-184V DC (check page 56 for Wiring Diagram)
Is there any voltage from the fan motor?
NO
Check the PCB
Yes
Check the voltage between #3 and #4 CN 8:
0-7.5V DC
Check fan assembly

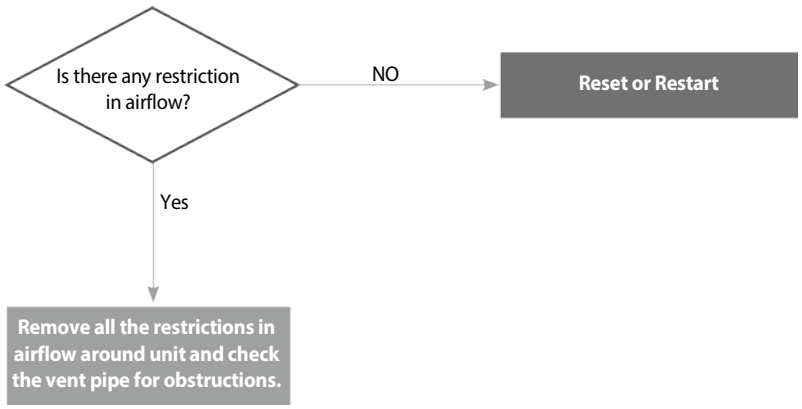
Check method

<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td rowspan="2">Fan action error</td><td>No fan operation</td><td>1. Check the power supply to the blower.
• Black+Red, approx. DC 127~184 V
2. Replace the PCB if voltages are abnormal. (When replacing the PCB, turn off the unit and then wait for at least 10 seconds before proceeding.)
3. If the issue continues despite the checking the items above, replace the fan motor.</td></tr>
<tr><td colspan="2"> 
Check if the fan motor wire is disconnected</td></tr>
<tr><td>Fan motor RPM error</td><td>Defective rotator</td><td>1. If RPM is significantly low while the fan is operating and the power supply is normal. Follow the instructions listed below and replace the fan.
1) Unplug the power cable to the unit and then wait for 10 seconds until the remaining SMPS voltage completely discharges.
2) Disconnect the fan cable and then re-connect it.
3) Plug the power cable and turn on the unit.
4) Fan Auto Adjusting verifies error conditions for error code E109. If an E109 error occurs, enter the Fan Test Mode and verify fan RPM and APS input voltage.(Display: ex. H.320 = 3200 RPM)
5) If RPM is low or there is a sensor circuit error, replace the fan.
Indicates an imminent hazardous situation which, if not avoided, may result in minor or moderate injury.
2. If the issue continues despite checking the items above, replace the PCB.</td></tr>
</table>

5.2.10 110Error

Error occurrence conditions and check items

Error	Description
E110 Air pressure error	The system senses the air volume and the RPM signal, and displays 110E on the front panel in the following cases: 1. When the initial fan auto-adjust is not performed. 2. When the unit capacity reaches up to 95% of the maximum heat during combusition, and APS is not up the standard value.
Check items	1. Check if the venturi (burner) hole is clogged. 2. Check if the condensation drain line or the drain is clogged. 3. Check the flue and exhaust to verify proper installation and clearances. (Circulation of exhaust gas generates noise.) 4. Check if the air supply/exhaust flue is clogged (rainwater may collect inside from an improperly installed air supply/exhaust pipe). 5. Defective air pressure sensor or PCB.


Is there any restriction in airflow?
NO
Reset or Restart
Yes
Remove all the restrictions in airflow around unit and check the vent pipe for obstructions.

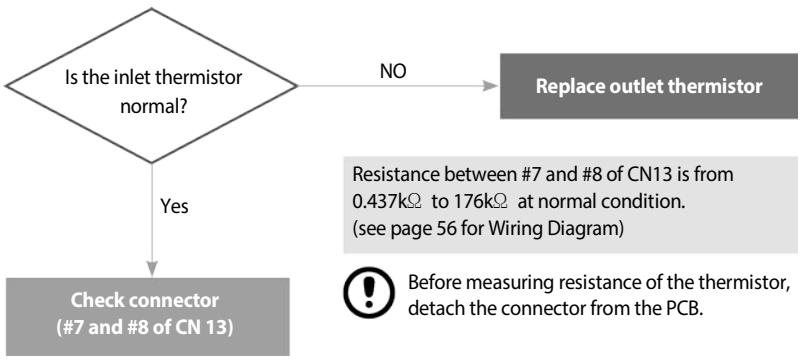
Check method

Fault	Possible Causes	Check method
110E Exhaust blockage	Abnormal flow of intake air supply / exhaust	1. If 110E occurs intermittently during ignition or combustion, compare the standard RPM with the current RPM at Min / Max combustion (dip switch 1-1&1-2). If the current RPM is higher than normal, check the following: • Air supply / exhaust vent for any blockages. • Blocked condensate drain • If the air pressure sensor hose is broken or clogged. 2. Replace the old PCB with the latest version.
Condensate drain error	Condensate drain error	Exhaust air is blocked due to condensate drain error. • Check if the condensate hose or the siphon is frozen. • Check if the condensate hose is kinked. • Remove bottom of trap and verify it is not blocked.
Defective air supply/exhaust flue	Deformed or clogged flue	1. Check the exterior of the flue for damage and obstructions. 2. Check if rainwater is collected due to vertical installation of the air intake pipe.
	Exhaust gas flows in through the supply pipe	If the exhaust gas enters into the air supply pipe, abnormal combustion may cause E110. • Check the installation of the flue.

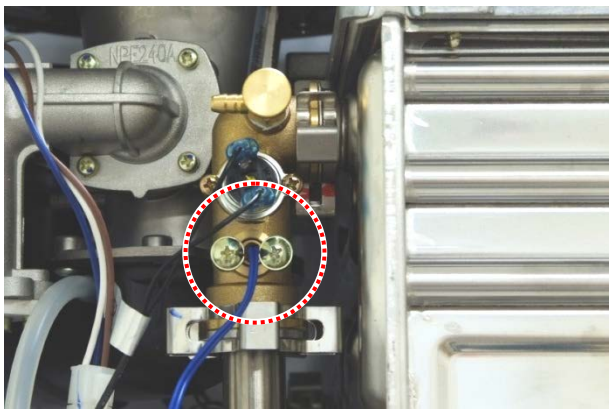
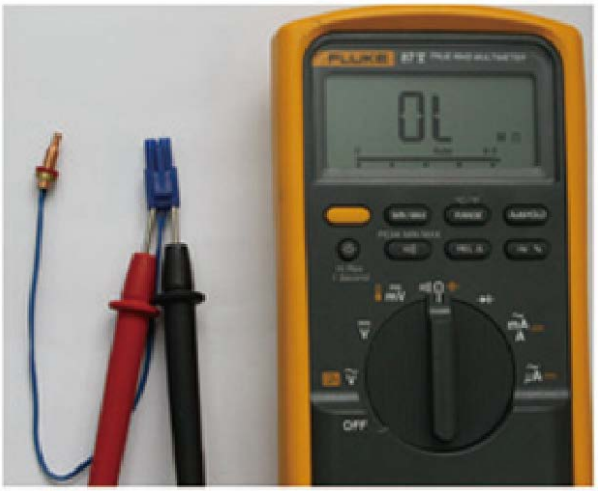
5.2.11 205Error

Error conditions and Check Items

Error	Description
E205 Heat exchanger output temperature sensor open	If an error (open: 14°F (-10°C) or lower) in the heat exchanger input temperature sensor is detected, the system displays the 421E error on the front panel. If this occurs, the boiler initiates shutdown.
Check items	1. Check if the heat exchanger output temperature sensor connector is wet due to any reason, including leakage. 2. Replace the defected heat exchanger output temperature sensor. 3. Replace the controller.


Is the inlet thermistor normal?
NO
Replace outlet thermistor
Yes
Check connector (#7 and #8 of CN 13)
Resistance between #7 and #8 of CN13 is from 0.437kΩ to 176kΩ at normal condition.
(see page 56 for Wiring Diagram)
Before measuring resistance of the thermistor, detach the connector from the PCB.

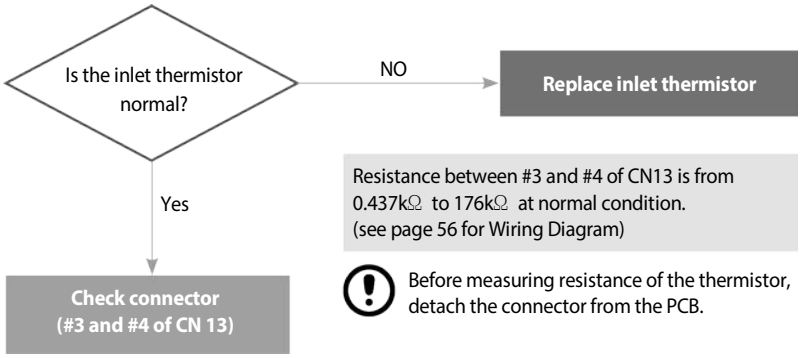
Check method

<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td rowspan="2">Defective sensor</td><td>Defective temperature sensor connector</td><td>Check if the temperature sensor is open and if the connector is connected properly.</td></tr>
<tr><td>Temperature sensor</td><td>Check the resistance of the temperature sensor. (Defective if it is 30kΩ or higher)
• Replace the temperature sensor if the resistance value is abnormal.
• Check the temperature displayed on the front panel.</td></tr>
<tr><td rowspan="2">Possible Issues</td><td>Defective PCB</td><td>If the issues continue despite checking the items above, replace the PCB.</td></tr>
<tr><td colspan="2"> 
<Heat exchanger output temperature sensor / connector>
 
Check if the secondary water temperature sensor is open Error type : MΩ Open></td></tr>
</table>

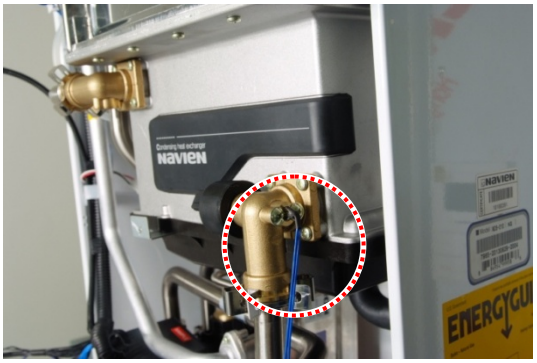
5.2.12 218Error

Error conditions and Check Items

Error	Description
E218 Heat exchanger input temperature sensor open	If an error (open: 14°F (-10°C) or lower) in the heat exchanger input temperature sensor is detected, the system displays the 421E error on the front panel. If this occurs, the boiler initiates shutdown.
Check items	1. Check if the heat exchanger input temperature sensor connector is wet due to any reason, including leakage. 2. Replace the defected heat exchanger input temperature sensor. 3. Replace the controller.


Is the inlet thermistor normal?
NO
Replace inlet thermistor
Yes
Check connector (#3 and #4 of CN 13)
Resistance between #3 and #4 of CN13 is from 0.437kΩ to 176kΩ at normal condition.
(see page 56 for Wiring Diagram)
Before measuring resistance of the thermistor, detach the connector from the PCB.

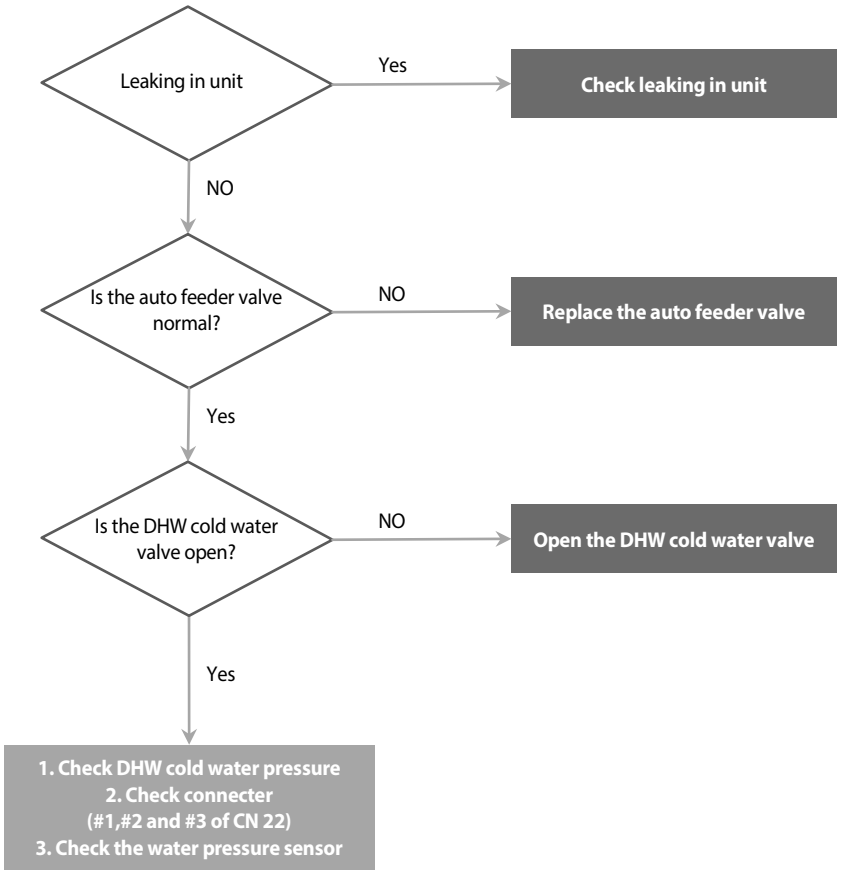
Check method

Fault	Possible Causes	Check method
Defective sensor	Defective temperature sensor connector	Check if the temperature sensor is open and if the connector is connected properly.
	Temperature sensor	Check the resistance of the temperature sensor. (Defective if it is 30kΩ or higher) • Replace the temperature sensor if the resistance value is abnormal. (refer to page 62) • Check the temperature displayed on the front panel. (refer to page 39)
Possible Issues	Defective PCB	If the issues continue despite checking the items above, replace the PCB.
		 <Heat exchanger input temperature sensor / connector> Check if the hot water temperature sensor is open (Error type : MΩ Open)

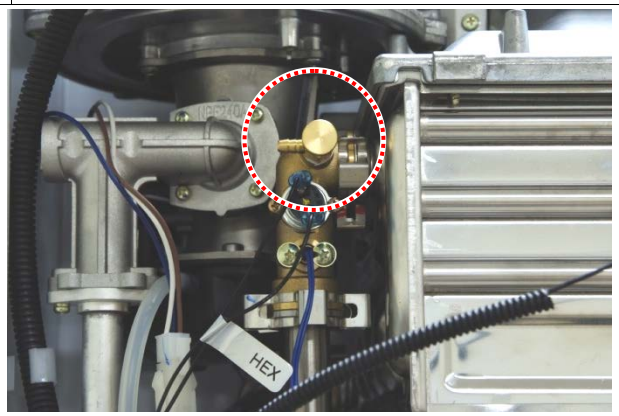
5.2.13 351Error

Error conditions and Check Items

Error	Description
E351 Abnormal Auto feeder valve	If the water pressure sensor senses low water level as the heating pipe pressure is low, the system stops operation of the boiler, and refills water automatically. If water is supplied by auto feeder valve open over 5 minutes, the error(E351) is detected and displayed on the front panel. If this occurs, the boiler initiates shutdown.
Check items	1. Water is not refilled. • Check if the cold water valve is closed or frozen. • Check if the auto feeder valve works normally. 2. Water overflows through condensed water hose. • Check the left drain valve of the main heat exchanger. • Check if water leaks due to a defective heat exchanger. 3. Check if water leaks from the heating pipe. 4. Check the auto feeder. 5. Check the water supplied pipe open. 6. Check the water pressure.



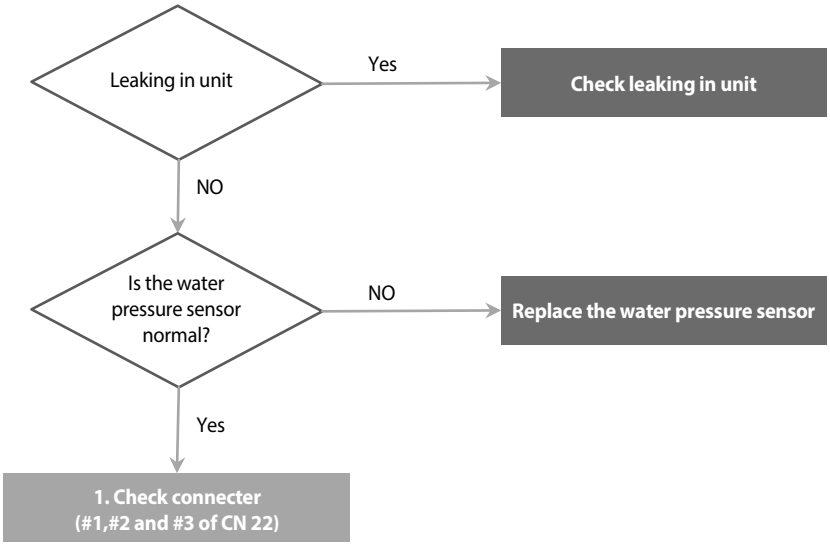
Check method

<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td>Water is not Refilled</td><td>Cold water valve is closed or frozen</td><td>Turn on cold water tap and check if the valve works or is frozen.</td></tr>
<tr><td rowspan="2">Water is not refilled</td><td>Defective auto feeder valve</td><td>1. Check the auto feeder valve filter if water is not refilled.
2. Check the power supply (DC 24V).
• Replace the auto feeder valve if power is supplied normally.
3. Replace the PCB if power is not supplied.</td></tr>
<tr><td colspan="2">
<Check if the filter is clogged with debris></td></tr>
<tr><td rowspan="3">Water flow over through the condensed water hose.</td><td>Drain valve open</td><td>Check the drain valve under the left of the main heat exchanger.</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td>Defective heat exchanger</td><td>Water leaks through the condensed water hose due to a defective heat exchanger.</td></tr>
<tr><td>Frequent 351E</td><td>Pipe leaks</td><td>Frequent water filling can occur due to leakage of pipe. Check the leakage on the pipe connector and distributor.</td></tr>
</table>

5.2.14 352Error

Error conditions and Check Items

Error	Description
E352 High water pressure	Upon receiving a signal from the water pressure sensor, the system displays the error(E352) on front panel. High water level error if the water level of 56.6PSI or higher continues 3 seconds. Error is automatically cancelled if water level is 43.5PSI or lower.
Check items	1. Check if the cold water pipe input water pressure sensor is wet due to any reason, including leakage.. 2. Check the Auto Feeder Sensor 3. Check the controller



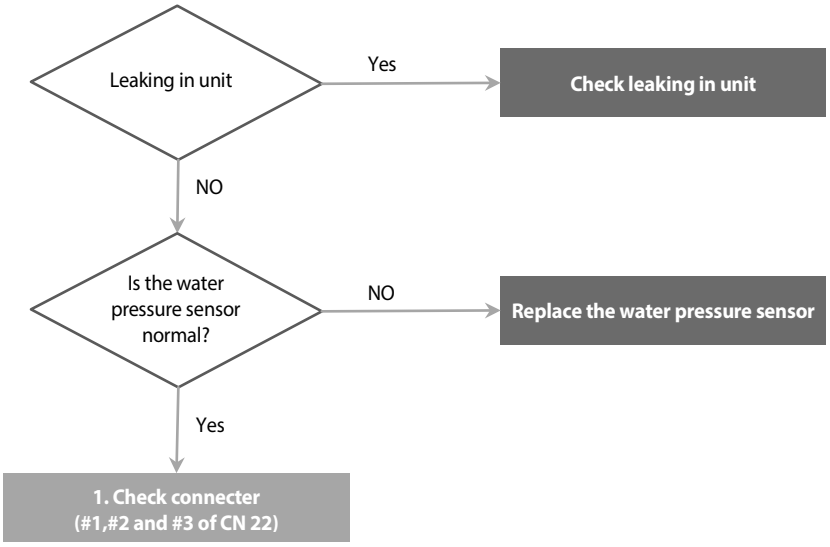
Check method

Fault	Possible Causes	Check method
E352	High water pressure	Check the pressure increase conditions. (high water pressure of 3.9bar or higher) Check if the safety valve is stuck. Check if Auto feeder valve is normal.
High water pressure sensor	Defective water pressure sensor	1. Check the output voltage. (Normal state : 0.3~2.8V) 2. Replace the defective or opened water pressure sensor.
	Defective Auto Feeder valve	1. Check the Auto feeder valve. (refer to page76)

5.2.15 353Error

Error conditions and Check Items

Error	Description
E353 Abnormal water pressure sensor	If an error (under 0.3V or over 2.8V) in the water pressure sensor is detected continuously for 3 seconds, The system displays the error message E353 on the front panel. If this occurs, the boiler initiates shutdown.
Check items	1. Check if the cold water pipe input water pressure sensor is wet due to any reason, including leakage.. 2. Replace the water pressure sensor 3. Check the controller



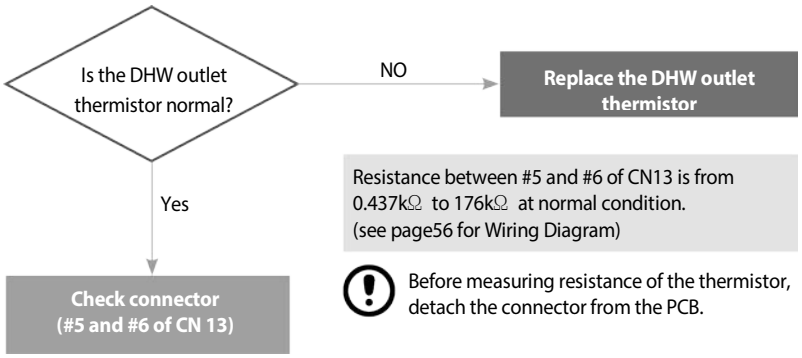
Check method

Fault	Possible Causes	Check method
Anormal water pressure sensor	Defective water pressure sensor	1. Check the sensor is frozen during the winter. 2. Check the output voltage. (Normal state : 0.3~2.8V) 3. Replace the PCB if power is not supplied.

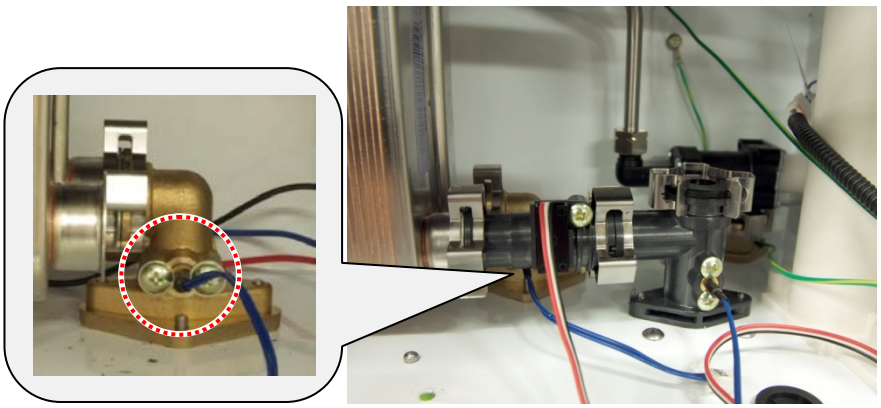
5.2.16 407Error

Error conditions and Check Items

Error	Description
E407 Hot water outlet thermistor open or short	If an error (open: 14°F (-10°C) or lower) in the DHW Outlet Elbow input temperature sensor is detected, the system displays the 407E error on the front panel.
Check items	1. Check if the hot water temperature sensor connector is wet due to any reason and if the connector is connected properly.. 2. Check if the temperature sensor is open or short


Is the DHW outlet thermistor normal?
NO
Replace the DHW outlet thermistor
Yes
Check connector (#5 and #6 of CN 13)
Resistance between #5 and #6 of CN13 is from 0.437kΩ to 176kΩ at normal condition.
(see page56 for Wiring Diagram)
Before measuring resistance of the thermistor, detach the connector from the PCB.

Check method

<table>
<tr><th>Fault</th><th>Possible Causes</th><th>Check method</th></tr>
<tr><td rowspan="2">Defective sensor</td><td>Defective temperature sensor connector</td><td>Check if the temperature sensor is open and if the connector is connected properly.</td></tr>
<tr><td>Temperature sensor</td><td>Check the resistance of the temperature sensor. (Defective if it is 30kΩ or higher)
• Replace the temperature sensor if the resistance value is abnormal. (refer to page 62)
• Check the temperature displayed on the front panel. (refer to page 39)</td></tr>
<tr><td rowspan="2">Possible Issues</td><td>Defective PCB</td><td>If the issues continue despite checking the items above, replace the PCB.</td></tr>
<tr><td colspan="2"> 
< DHW outlet elbow input temperature sensor / connector>

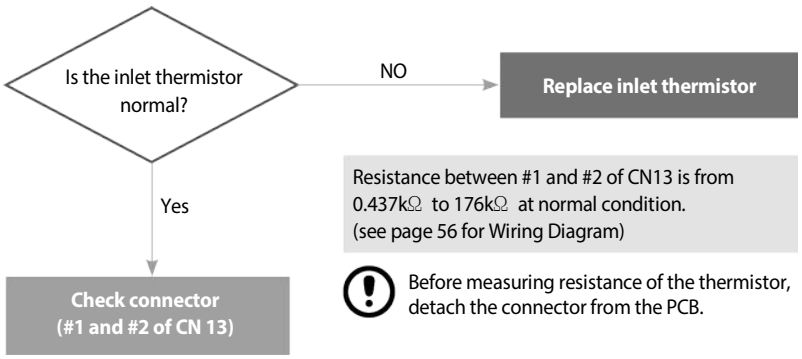
NOTE
1. The wire color of hot water sensor is changed to red from blue(after October.20.2013) for correct assembly.
2. They are compatible with each other. But be careful the incorrect connection. before connecting the thermistor up to wire terminal, please check the label of end of the harness.

Check if the hot water temperature sensor is open (Error type : MΩ Open)</td></tr>
</table>

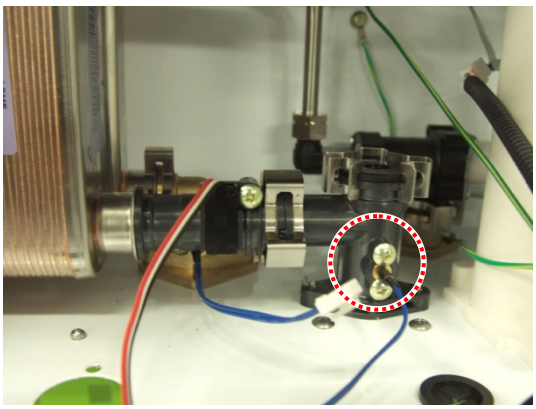
5.2.17 421Error

Error conditions and Check Items

Error	Description
E421 Cold water inlet thermistor open or short	If an error (open: 14°F (-10°C) or lower) in the DHW Outlet Elbow input temperature sensor is detected, the system displays the 421E error on the front panel.
Check items	1. Check if the cold water temperature sensor connector is wet due to any reason and if the connector is connected properly.. 2. Check if the temperature sensor is open or short


Is the inlet thermistor normal?
NO
Replace inlet thermistor
Yes
Check connector (#1 and #2 of CN 13)
Resistance between #1 and #2 of CN13 is from 0.437kΩ to 176kΩ at normal condition.
(see page 56 for Wiring Diagram)
Before measuring resistance of the thermistor, detach the connector from the PCB.

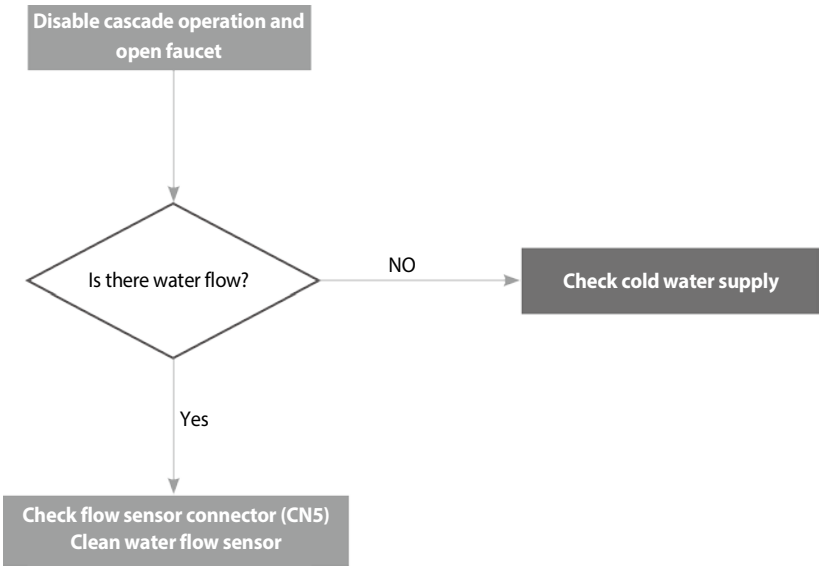
Check method

Fault	Possible Causes	Check method
Defective sensor	Defective temperature sensor connector	Check if the temperature sensor is open and if the connector is connected properly.
	Temperature sensor	Check the resistance of the temperature sensor. (Defective if it is 30kΩ or higher) • Replace the temperature sensor if the resistance value is abnormal. (refer to page 62) • Check the temperature displayed on the front panel. (refer to page 39
Possible Issues	Defective PCB	If the issues continue despite checking the items above, replace the PCB.
		 <DHW Flow sensor input temperature sensor / connector> Check if the hot water temperature sensor is open (Error type : MΩ Open)

5.2.18 439Error

Error occurrence conditions and check items

Error	Description
E439 Flow sensor error	As one or more units are operating in the cascade system, if no flow is detected during DHW using, the system considers it as a defective flow sensor. The system displays 439E (cleared manually) on the front panel and switches the unit operation into the Lock-Out mode (gas valve and ignition transformer locked).
Check items	1. Check the supply of cold water while the cascade system is disabled. (frozen/locked valve). 2. Defective flow sensor. 3. Defective PCB.



Check method

Fault	Possible Causes	Check method
No hot water flow	Cold water supply error	1. Check if the cold water line is frozen. 2. Check if the cold water filter is clogged.
Boiler not working	Defective flow sensor	1. Check the current flow displayed on the front panel. • If the flow sensor is defective, the displayed flow value is 0.0 while water flows from the hot water tap. • Remove the flow sensor and blow into it. The rotation detector on the flow sensor is defective if the impeller rotates and display remains 0.0. * Component Test mode may also be used to check the operation of the flow sensor (refer to page 21). 2. Check connector assembly and contact of the flow sensor. 3. Check the input voltage of the flow sensor. • Operating voltage (Black + Red) : Defective PCB if DC 12 V is not supplied. 4. Replace the flow sensor if no flow is detected while the operating voltage is normal.
Other trouble	Defective PCB	If the issue continues despite the checking of items above the PCB is defective.

Emergency measures for a defective flow sensor

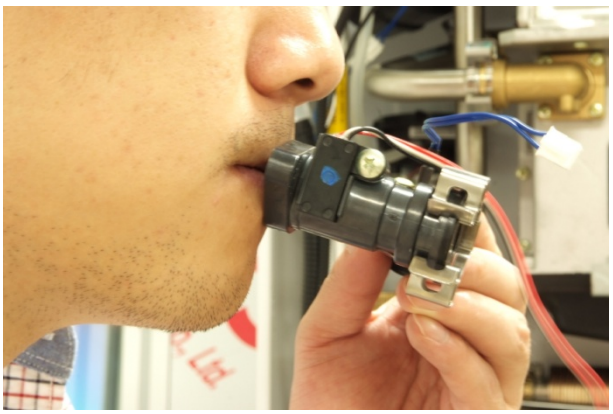
Replacement of the part is usually required for the boiler to operate when an error occurs with the flow sensor. If it is impossible to replace the part immediately, use the following emergency measures.

If the flow sensor impeller is stuck due to foreign substances:

Remove the flow sensor and blow air through the part from the inlet side. If the impeller does not rotate, disassemble the impeller, and remove the foreign substance before reassembling it.

If the flow displayed on the front panel is 0.0, and the impeller rotates when you blow into it, the flow sensor will need to be replaced.

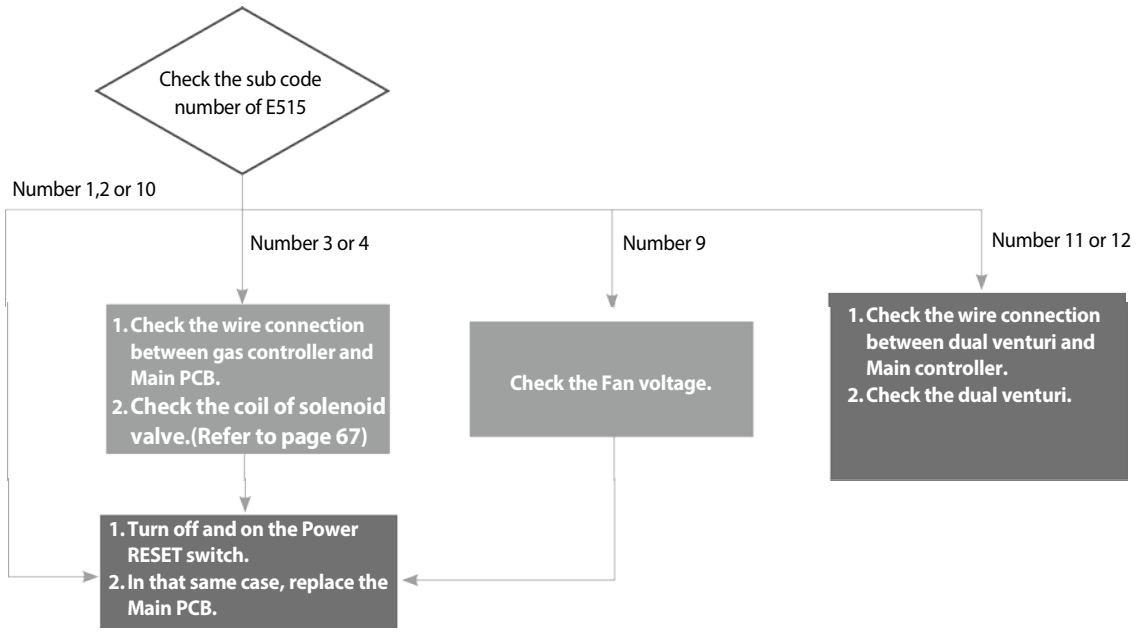
1. Drain water from the unit, then remove the flow sensor (refer to page 127).
2. Blow air through the flow sensor. Check that the impeller rotates freely.



5.2.19 515Error

Error occurrence conditions and check items

Error	Description
E515 error	If an error occurs in the internal circuit of the PCB (e.g., resistance, transistor or relay fault), the system displays 515E (cleared manually) on the PCB.
Check items	1. Defective PCB 2. Check with a multimeter if the PCB is supplied with the proper voltage (AC 102~132 V). 3. Check the wire connection. 4. Disconnect the ground wire, then check the PCB

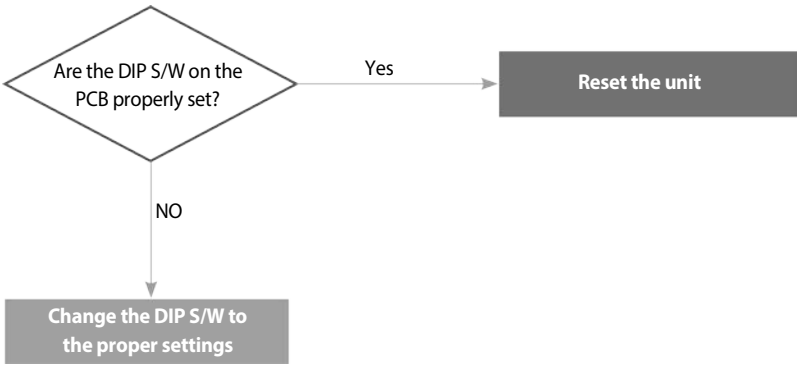

Check the sub code number of E515
Number 1,2 or 10
Number 3 or 4
Number 9
Number 11 or 12
1. Check the wire connection between gas controller and Main PCB.
2. Check the coil of solenoid valve.(Refer to page 67)
Check the Fan voltage.
1. Check the wire connection between dual venturi and Main controller.
2. Check the dual venturi.
1. Turn off and on the Power RESET switch.
2. In that same case, replace the Main PCB.

Check method

Fault	Possible Causes	Check method
PCB or Electrical supply	Defective PCB	Replace the PCB if there is an error with the PCB internal circuit.
	Power supply error	Check with a multi-meter if the PCB is supplied with the proper voltage. • Check with a multi-meter if the voltage at the electrical outlet is AC 102~132 V.
	Power supply grounding noise	Power supply grounding noise causes malfunction. • Disconnect ground from the grounding terminal inside the unit, and check if the PCB is operating normally.

5.2.20 517Error

Error occurrence conditions and check items



5.2.21 594Error

Error occurrence conditions and check items

Error	Description
E594 error	If the communication is abnormal in parts of PCB, the system displays E594 on the PCB.
Check items	Check the PCB.

Error occurrence conditions and check items

Fault	Possible Causes	Check method
E594 Error	Abnormal communication by PCB.	1. Click the Reset button on Front panel. 2. Turn the POWER to the unit OFF then ON. Disconnect then reconnect power if necessary. 3. If the system still displays E594, replace the main PCB.

5.2.22 615Error

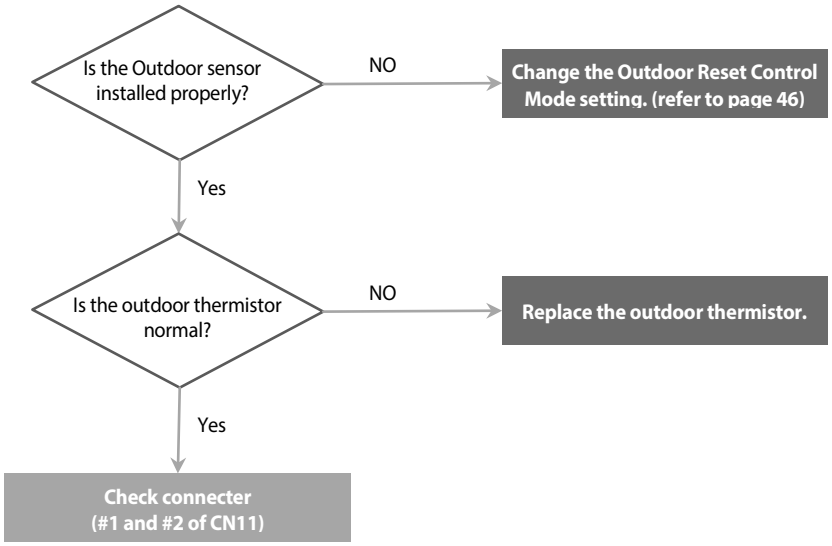
Error occurrence conditions and check items

Error	Description
E615 error	Abnormal signal input by PCB.
Check items	1. Turn the POWER RESET switch OFF then ON (or unplug and replug the power supply. 2. If the system still displays E615, replace the main PCB.

5.2.23 740Error

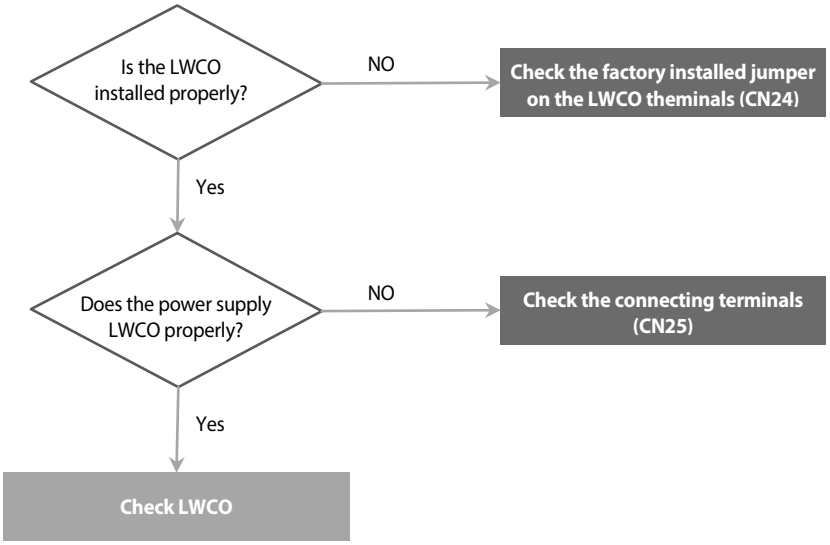
Error conditions and Check Items

Error	Description
E740 Abnormal outdoor sensor	If an error (under 2.2kΩ or over 122.2kΩ) in the outdoor sensor is detected continuously for 3 seconds, The system displays the error message E740 on the front panel. If this occurs, the boiler changes the control mode from Reset Curve Mode to Normal Mode.
Check items	1. Check the parameter setting. (refer to page 46) 2. Check the outdoor sensor


Is the Outdoor sensor installed properly?
NO
Change the Outdoor Reset Control Mode setting. (refer to page 46)
Yes
Is the outdoor thermistor normal?
NO
Replace the outdoor thermistor.
Yes
Check connecter (#1 and #2 of CN11)

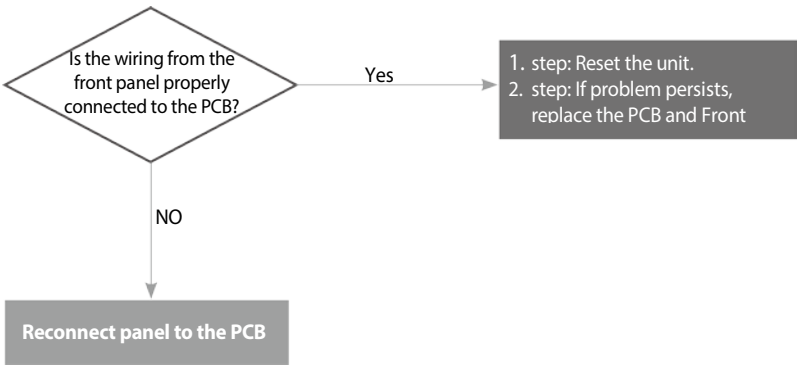
5.2.24 777Error

Error conditions and Check Items



5.2.25 782Error

Error occurrence conditions and check items


Is the wiring from the front panel properly connected to the PCB?
Yes
1. step: Reset the unit.
2. step: If problem persists, replace the PCB and Front
NO
Reconnect panel to the PCB

5.3 Troubleshooting guide by symptom

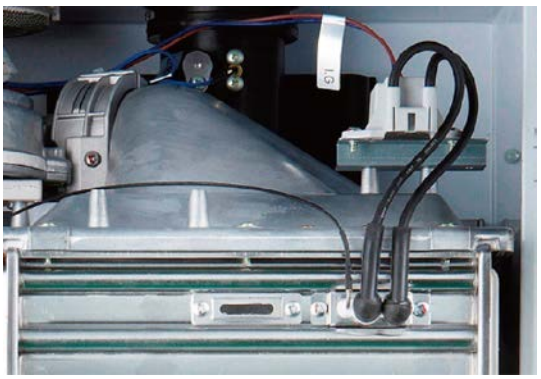
5.3.1 Noise

Error type	Cause	Check method
Vibration noise	Defective installation	Incorrect mounting to the wall or in an improper location. • Check for improper installation and reinstall the unit if necessary.
	Fan vibration noise	Vibration caused due to defective blower. • Check the blower. If vibration is significant, replace the fan. • If intermittent noise occurs during operation, check the fan for debris. • If vibration noise occurs during operation of the product, and stops when the case lid is removed, check the fan.
Regular noise	Defective flow sensor	Rotating noise due to debris caught in the flow sensor.
	Malfunction of water adjustment valve	Noise due to repeated opening/closing of water adjustment valve due to a defective PCB.
Noise at ignition	Gas and air differential pressure error (Pop, Beep, Explosive ignition)	1. Offset pressure adjustment error (refer to page 30) • Adjust offset pressure with the pressure adjusting screw on the main gas valve. • Set the PCB DIP 4-switch to 1-OFF,2-ON (low fire) or use the Front Panel to set the unit at "MIN.1" (refer to page 54). • If noise occurs at standard value, adjust setting above/below the standard. 2. Gas supply error due to defective air pressure sensor. 3. If the same error is repeated, it is due to a defective PCB.
Noise during combustion	Boiling noise	• How to check boiling: • Boiling occurs if the water temperature rises to149 °F ~167 °F(65 °C~75 °C). • The heat exchanger is clogged partially due to scale deposits. Flush the main heat exchanger to remove scale. • Replace the heat exchanger if the error occurs from the start of the installation.
	Whirring	Exhaust gas that is recirculated into the boiler through the air inlet could produce abnormal combustion noises. • Check the distance between intake and exhaust (at least 12" (300mm)). • Check the distance between flues if two or more units are installed (at least 12" (300mm)). • Check if there are any obstructions near the flue.
	Low gas pressure (whirring)	1. Noise occurs due to low gas pressure. • Check the gas supply pressure (dynamic pressure) 2. Low gas supply due to offset pressure error. (refer to page 30) • Set the PCB DIP 4-switch to 1-OFF,2-ON (low fire) or use the Front Panel to set the unit at "MIN.1" (refer to page 54).
		Noise due to defective air pressure sensor. • Replace the air pressure sensor.
	Noise during combustion	• Noise due to damaged air pressure hose. • Noise may be intermittent depending on the size of the damage.

5.3.2 Water Temperature Issue

Error type	Cause	Check method
Boiler is not operating properly.	Front panel power off	Hot water does not run if the front panel is switched off.
	Defective flow sensor	The boiler does not work due to the defective flow sensor. • The flow sensor impeller will not rotate if it contains excessive scale or debris. Clean out the flow sensor if possible. • If the impeller rotates normally, replace the flow sensor back into the boiler. • The sensor may be reused temporarily after cleaning, but replacement is recommended.
	Defective hot water temperature sensor	The temperature is sensed higher than the actual temperature due to a defective hot water (cold water) sensor. • Hot water temperature is low although hot water is recognized by the boiler. • The cold water temperature sensor may not work be working properly.
Low hot water temperature	Hot water setting error	Check the hot water temperature setting on the front panel.
	Water mixed with cold water.	The temperature of hot water at the tap is low while the temperature is high at the hot water outlet. • Cold water and hot water are mixed due to improper pipe installation. • Cold water and hot water are mixed due to improper piping at the hot water faucet.
No hot water from the valve	Check the pipe	1. The cold water valve is closed. 2. Check if the cold water filter is clogged with foreign substance. 3. Check if the cold water / hot water pipes are frozen during the winter. 4. The main heat exchanger is clogged (by scale). 5. Low inlet water pressure
Cold water flows temporally	Pre-heating does not work	For the A model, the system initiates the internal/external circulation preheating when a recirculation mode is selected on the front panel DIP switches. Confirm the DIP switch settings.

5.3.3 Circuit breaker operation

<table>
<tr><th>Error type</th><th>Cause</th><th>Check method</th></tr>
<tr><td rowspan="4">Circuit breaker trips</td><td>Power supply</td><td>The circuit breaker trips immediately as soon as the power cord is plugged in the receptacle.
Check the sheath of power cord, or if there is short-circuit.
Check the components in order from the power transformer to the PCB.</td></tr>
<tr><td>Defective part assembly</td><td>If the circuit breaker operates after repairs check the wiring of each part.
Maintain proper direction when assembling the ignition transformer.
Be careful that wire is not compressed when assembling the main gas valve
Check if the wire is fixed and properly attached on the main side of the heat exchanger.</td></tr>
<tr><td colspan="2"> 
Normal assembly

Short-circuit due to defective assembly

Wiring near the heat exchanger</td></tr>
<tr><td>Circuit breaker operates while the boiler is running</td><td>If circuit breaker trips during the operation of the boiler, check the order of operation, and replace the concerned part.
e.g., The circuit breaker operates at switchover to burner stage 2 after ignition.
► Replace the dual venturi.</td></tr>
<tr><td>Remote controller power</td><td>Check the wire</td><td>Check the power supply to the remote controller terminal. (DC 19 V or higher).
If there is a problem in power supply, check the output voltage of the PCB, and take the action separately for wiring error and defective PCB, respectively.
If the power supply is normal, replace the remote controller.</td></tr>
</table>

6. Replacement of Parts

6.1 Replacement Procedure

CAUTION

1. When performing maintenance and/or servicing the boiler, always turn off the electric power, gas and water shut-off valve. Wait for the boiler to become cool. Be careful to avoid injury to your fingers on sharp edges.
2. Drain all water from the boiler when removing the waterway components.
3. Before any disassembly, make sure that all issues and error codes are properly diagnosed.
4. Handle all parts carefully.
5. When reassembling, prevent any foreign substance, i.e. dust, etc. from entering back into the boiler.
6. After reassembling, check for gas and water leakage. Then, test for proper ignition. Make sure that there is no gas leakage from the gas connections by testing with soap bubble solution. Bubbles indicate a gas leak that must be corrected.
7. Check the performance and operation after the boiler has been serviced.

To remove and replace any parts from the boiler, you will need a screwdriver that is at least 8 ~ 10 inches long. A flashlight and magnetic tip are also recommended. Navien recommends the use of a parts tray to hold small parts and screws. All of the hardware is essential to the proper operation of the unit upon re-assembly.

NOTE

When disassembling and reassembling the boiler, refer the components diagram & parts list.

6.2 Components Replacement Instructions

6.2.1 PCB

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Disconnect wiring connector from the Front Panel.

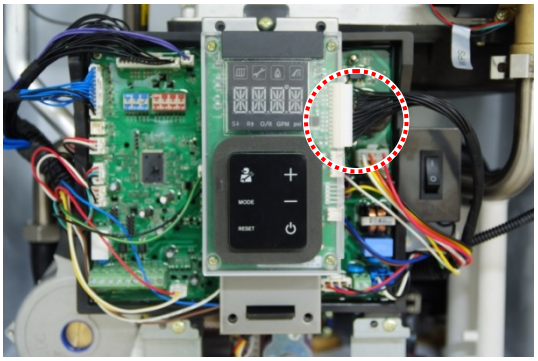


Figure 1

5. Disconnect all wiring connectors from the PCB

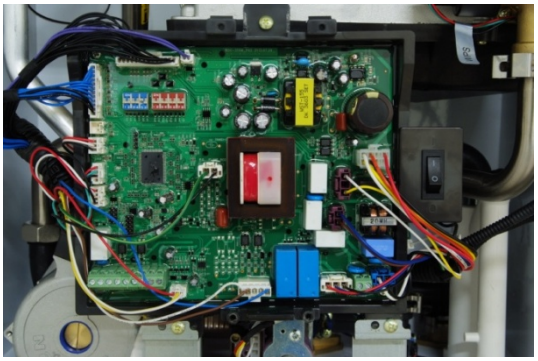


Figure 2

6. Remove the 3 screws from bottom PCB bracket and upper PCB bracket.

7. Remove the old PCB and replace it with the new part.
8. Reattach all wiring connectors to the PCB.
9. Set the proper DIP S/W settings on the PCB (refer to page 121).
10. Reinstall the PCB and Front Panel using the 7 screws previously removed.
11. Turn on the water and gas supplies, then reconnect the power supply to the unit.

NOTE

All wiring harness connections to the PCB should match in color and pintypes. Do not use excessive force when removing the connectors as this may cause damage to the PCB.

6.2.2 Fuse

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Locate the fuse housing shown in Figure 3 below. Open the housing to expose the fuse.

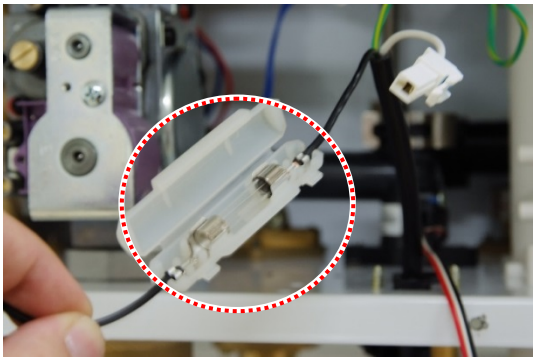


Figure 3

4. Replace the old fuse with the new part.
5. Ensure that the new fuse is of an equivalent rating and that it is properly fixed inside the housing.
6. Close the fuse housing.
7. Turn on water supply, power supply, and gas supply to the unit.

6.2.3 Fan Motor (Combustion Air)

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the mounting screw from the fan assembly as shown in Figure 4 below.
5. Remove the fan assembly bracket with the attached intake port.

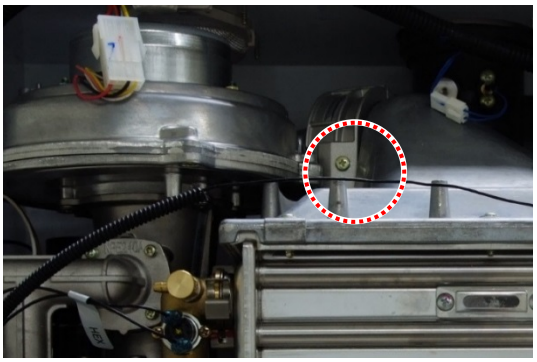


Figure 4

6. Disconnect the wiring connector from the fan assembly, and then remove the 4 screws from the gas valve connection as shown in Figure 5 below.

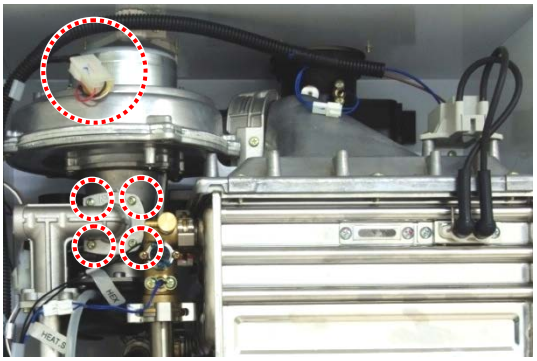


Figure 5

7. Pull out the fan assembly and remove the 4 screws that secure the air intake port to the fan assembly.

8. Remove the four screws from the bottom of the fan assembly.

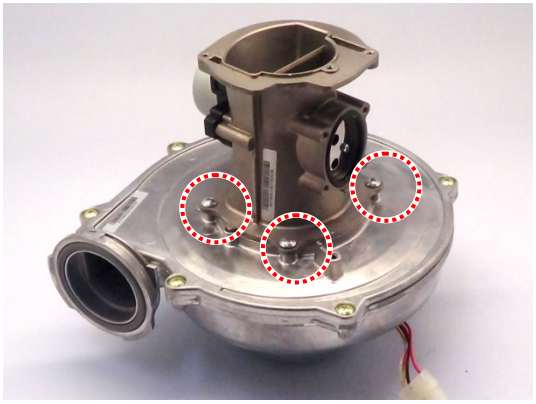


Figure 6

9. Detach the fan motor from the assembly and replace it with the new part.
10. Replace the 4 screws used to attach the fan motor to the assembly.
11. Reinstall the fan assembly to the bracket by using the mounting screw.
12. Attach the gas valve connection back to the fan assembly by using the 4 screws as shown in Figure 5.
13. Reconnect the wiring connector from the fan assembly.
14. Turn on water supply, power supply, and gas supply to the unit.

NOTE

Do not over-tighten the screws for the fan motor replacement with high torque drill. This may cause damage to the part(s).

6.2.4 Flame Rod

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the Ignition Transformer insulated cables.
5. Remove the 2 screws from the flame rod as shown in Figure 7 below.

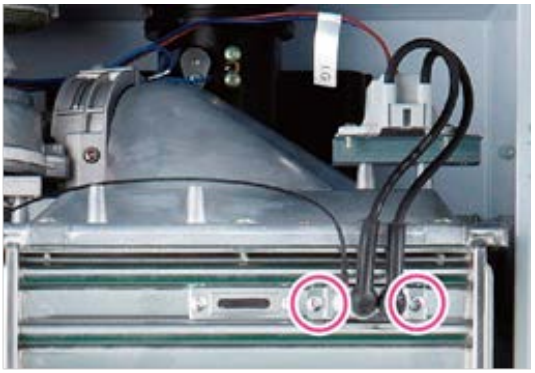


Figure 7

6. Remove the flame rod wiring connector.

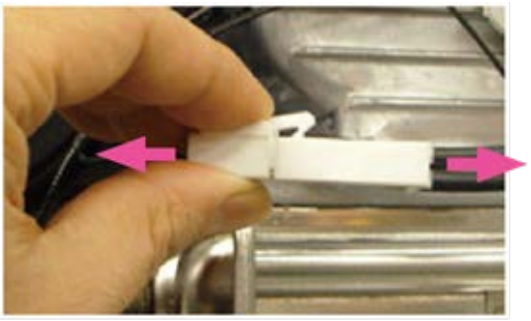


Figure 8

7. Remove the flame rod from the burner assembly and replace with the new part.
8. Reconnect the 2 ignition transformer insulated cables to the new flame rod.
9. Place the new flame rod back onto the burner assembly and secure it by using the 2 screws from Figure 7.
10. Turn on water supply, power supply, and gas supply to the unit.

NOTE

Always use new factory gaskets included with the flame rod when replacing the part onto the burner assembly.

6.2.5 Ignition Transformer

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the Ignition Transformer insulated cables from the flame rod.
5. Disconnect the wiring connector from the Ignition Transformer (Figure 9).

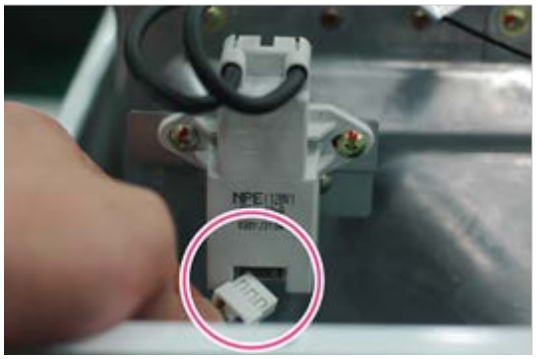


Figure 9

6. Remove the 2 screws from the Igniter Transformer.

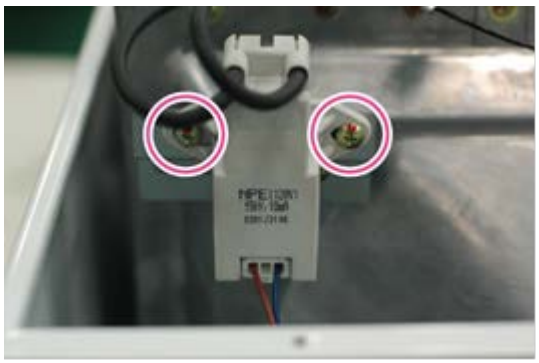


Figure 10

7. Pull out the Ignition Transformer.
8. Replace the old Ignition Transformer with the new part, and then use the 2 screws to secure the part.
9. Reconnect the Ignition Transformer insulated cables to the flame rod.
10. Reattach the wiring connectors from the Ignition Transformer.
11. Place the front panel back onto the unit and secure it by using the 4 screws.
12. Turn on water supply, power supply, and gas supply to the unit.

NOTE

Verify that the Ignition Transformer insulated cables are firmly connected to the flame rod.

6.2.6 APS

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the air pressure sensor wiring connector (Figure 11).

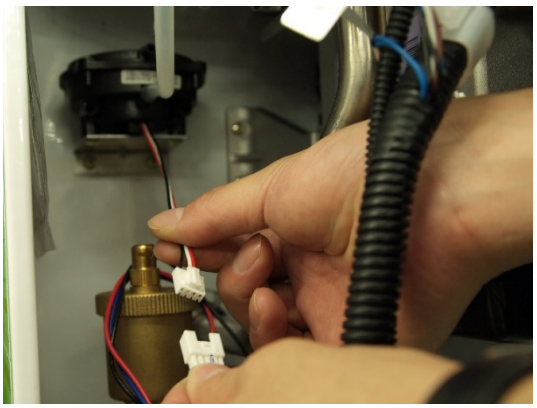


Figure 11

5. Remove the hose from the air pressure sensor.

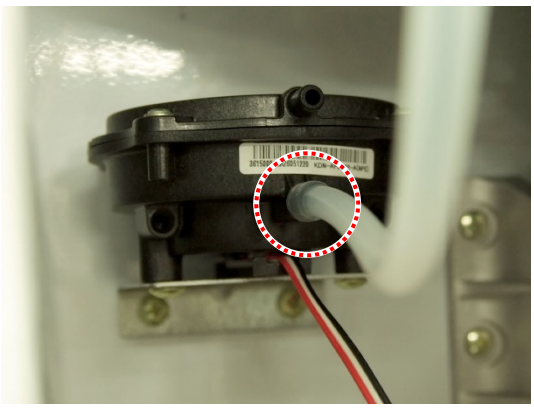


Figure 12

6. Remove the 2 screws that attaches the air pressure sensor to the burner assembly.
7. Pull out the air pressure sensor.
8. Replace the old air pressure sensor with the new part.
9. Reattach the air pressure sensor hose.
10. Connect the air pressure sensor wiring connector.
11. Place the front panel back onto the unit and secure it using the 4 screws.
12. Turn on water supply, power supply, and gas supply to the unit.

NOTE

Confirm that the new air pressure sensor is in the proper position before turning the unit back on.

6.2.7 Main Gas Valve

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the PCB (See page 121)

5. Remove the 2 screws and disconnect the wiring connector at the gas valve.

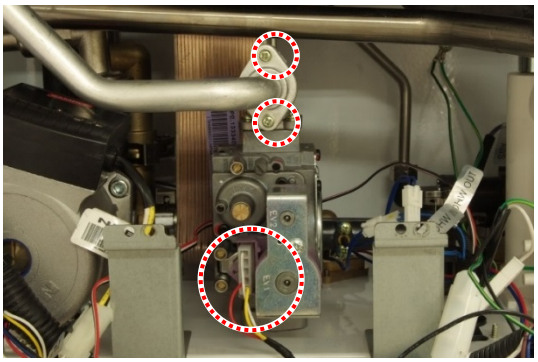


Figure 13

6. Remove the 2 screws located at the bottom of the unit that are attached to the gas valve.

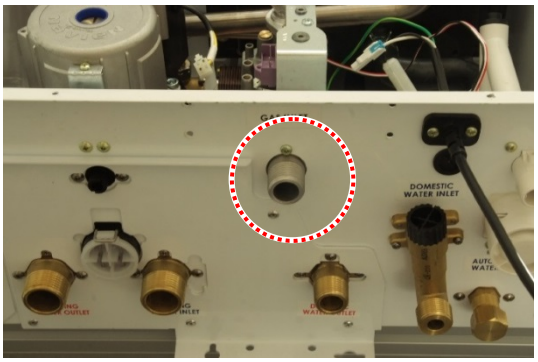


Figure 14

Remove the 8 screws directly on the bottom of the gas valve to remove the gas pipe.

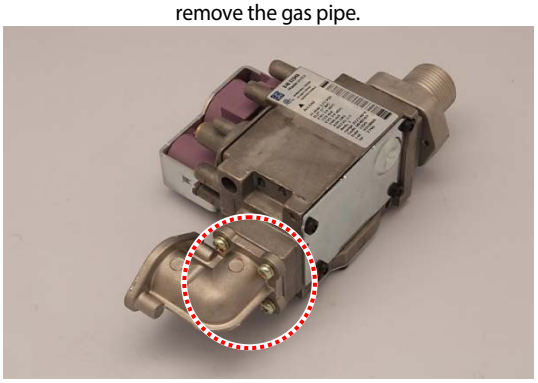


Figure 15

7. Remove the 4 screws directly from the bottom of the gas valve to remove the elbow.

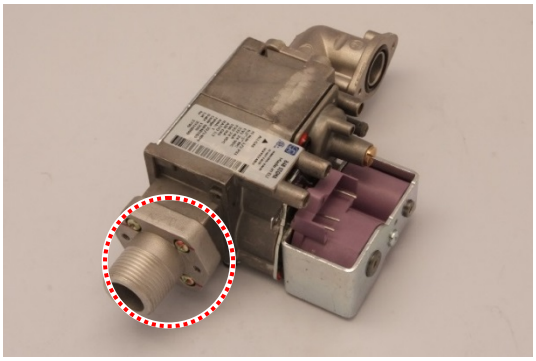


Figure 16

8. Replace the O-ring where the gas valve assembly attaches to the elbow. Make sure the old O-ring is discarded.
9. Replace the old gas valve with the new part and reattach the elbow and gas pipe to the gas valve.
10. Reconnect the gas valve assembly to the unit by using the 4 screws at the elbow and 2 screws at the gas pipe.
11. Reattach the gas valve wiring connector.

WARNING

Failure to correctly assemble the components according to these instructions may result in a gas leak or explosion.

12. Check that all gas connections are tightly sealed to ensure that no gas leaks are present.
13. Turn on water supply, power supply, and gas supply to the unit.
14. Verify the gas pressures to the unit with the values provided in this Service Manual.

NOTE

Always replace the old O-rings and gaskets with new parts to ensure tight seals between connections. Ensure that all properly sized O-rings are used for the replacement.

6.2.8 Condensate Trap

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Remove the pin that secures the condensate drain cap and then remove the cap. Use a bucket to collect the condensate.

Figure 17

5. Detach the condensate piping from the unit.
6. Remove the 2 screws located at the bottom of the unit that are attached to the condensate trap.
7. Loosen the clip that secures the hose to the condensate trap, and then pull off the hose.
8. Remove the old condensation trap and replace it with the new part.
9. Reconnect the hose to the condensate trap.
10. Reattach the condensation trap to the unit and secure it using the 5 screws.
11. Replace the controller to its original position.
12. Turn on the water supply, power supply, and gas supply to the unit.

NOTE

Ensure that the condensate drain trap is completely inserted into the condensate fitting to eliminate leaking. Use the pin to secure the cap to the fitting.

6.2.9 Flow Sensor

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Remove the main gas valve (refer to page 125)
5. Remove the stainless fastener.

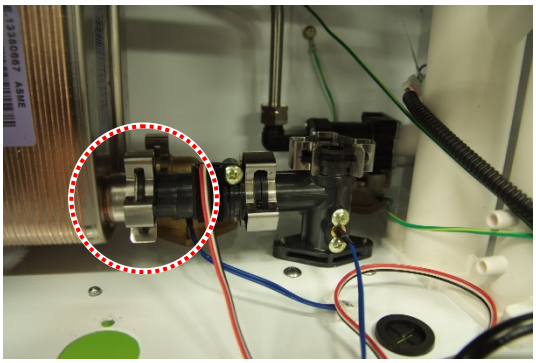


Figure 18

6. Remove two screws of Domestic Cold Water Inlet Adaptor from bottom of case.

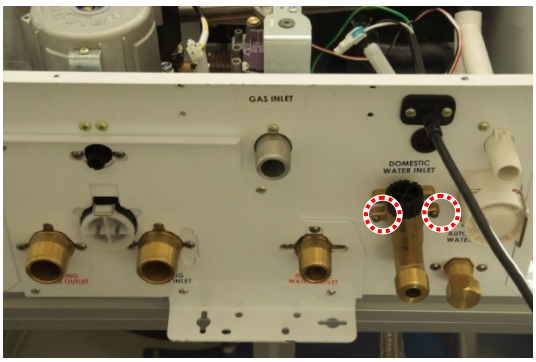


Figure 19

7. Detach the 2 wire connectors that connect the flow sensor to the PCB.
8. Pull out the flow sensor.

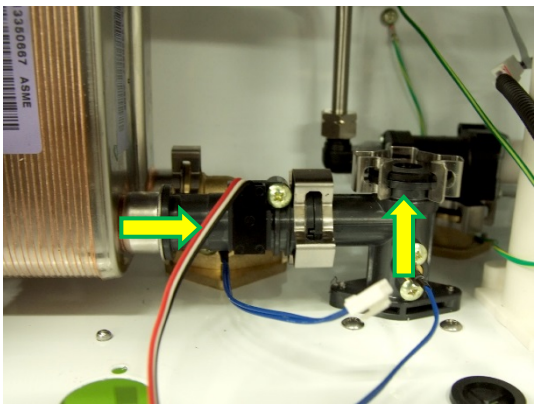


Figure 20

9. Replace with old flow sensor with the new part.
10. Reinstall the flow sensor into heat exchange and reattach the stainless clip. Ensure that the flow sensor is properly connected to the heat exchanger and that the clip is tightly holding the two parts together.
11. Reinstall the two screws at the flow sensor to secure the part to the Domestic Cold Water Inlet Adaptor.
12. Turn on water supply, power supply, and gas supply to the unit.
13. Carefully open a hot water tap and ensure there are no leaks at the flow sensor connections.

6.2.10 Circulation Pump

1. Turn off the gas supply to the unit.
2. Disconnect the unit from the power supply.
3. Turn off the water supply to the unit.
4. Open the drain plug on the pump and Remove the 4 screws from the bottom of the case.

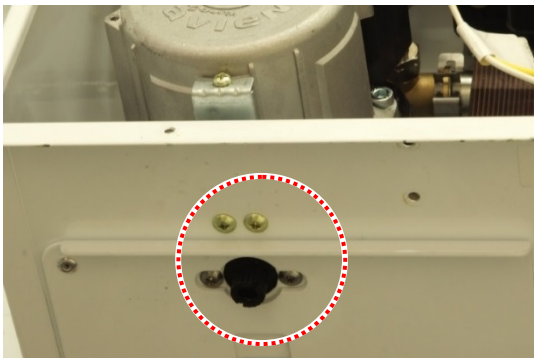


Figure 21

5. Remove the stainless nut, fastener and circulation pump wiring connector (Figure 22).

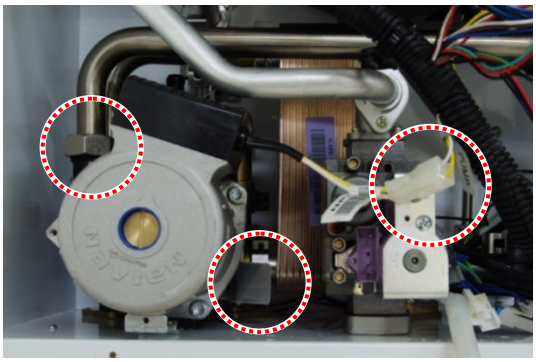


Figure 22

6. Carefully remove the pump.

Figure 23

7. Remove the air vent..

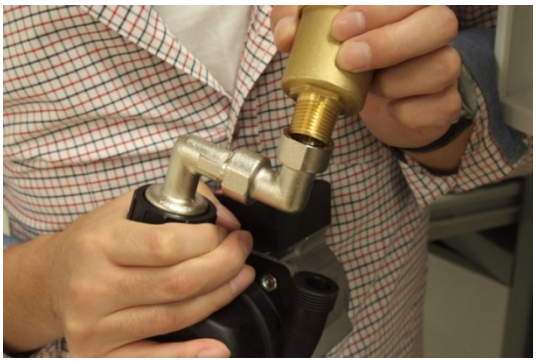


Figure 24

8. Replace with the new circulation pump (or Air Vent).
9. Place the new pump back into its original position and ensure that all connections are tightly sealed.
10. Secure the pump with the stainless steel clip and the 2 fixing screws.
11. Reinstall the pump drain plug at the bottom of the unit.
12. Reconnect the wiring connector at the pump.
13. Install the Main PCB back onto the unit by using the four screws.
14. Turn on water supply, power supply, and gas supply to the unit.
15. Open a hot water tap and ensure that there are no leaks at the pump connections.
16. Open the air vent on top of pump to release air within the system.

NOTE

Always use proper O-rings at the pump connection to ensure tight seals

6.2.11 3-way Valve

1. Turn off the gas supply to the unit.
2. Turn off the 120V power supply to the unit.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Remove the Circulation Pump (see page 127)
5. Remove the fastener and two screws on the 3-way valve.

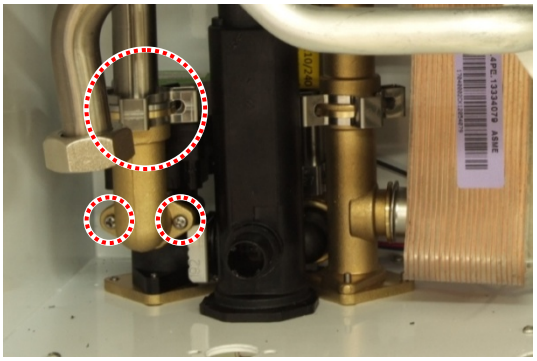


Figure 25

6. Remove the two screws on the bottom of case.

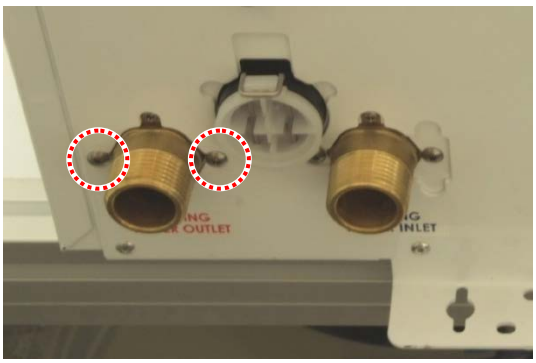


Figure 26

6.2.12 Water Pressure Sensor

1. Turn off the gas supply to the unit.
2. Turn off the 120V power supply to the unit.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Disconnect the water pressure sensor wire housing.

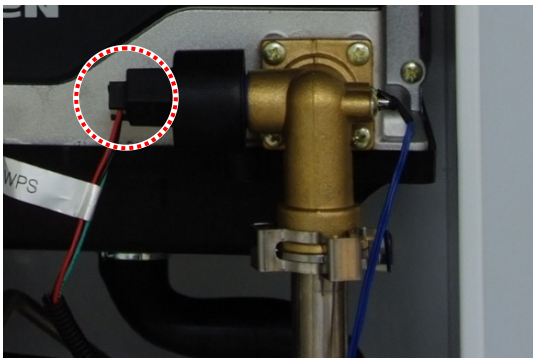


Figure 27

5. Pull out the water pressure sensor.
6. Replace with new water pressure sensor.
7. Connect the water pressure senor wire housing.

> **NOTE**
>
> Always use proper O-rings at the water pressure valve connection to ensure tight seals

6.2.13 Space Heating Strainer

(Filter Cleaning or Strainer Replacement)

1. Turn off the gas supply to the unit.
2. Turn off the 120V power supply to the unit.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Remove the stainless pin from the space heating strainer body.

Figure 28

5. Pull out the space heating strainer.

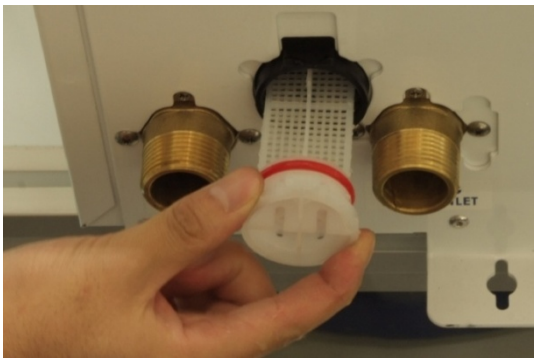


Figure 29

6. Replace with new strainer filter.

6.2.14 Auto Feeder Valve

1. Turn off the gas supply to the unit.
2. Turn off the 120V power supply to the unit.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Remove the siphon
5. Disconnect the wiring connector, fastener and remove the stainless nut from the Auto feeder valve.

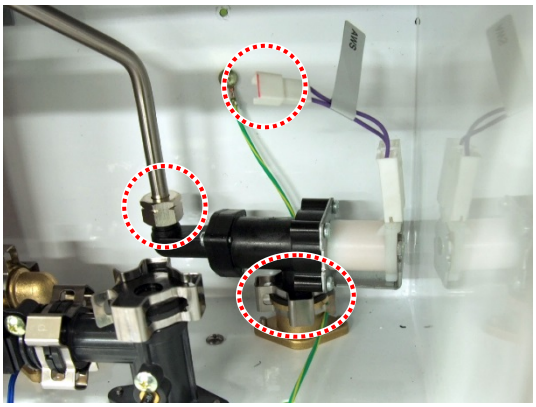


Figure 30

6. Replace with Auto feeder valve.

6.2.15 DHW Heat exchanger

1. Turn off the gas supply to the unit.
2. Turn off the 120V power supply to the unit.
3. Turn off the water supply to the unit. Drain all water from the appliance.
4. Remove the flow Sensor. (refer to page 127)
5. Remove the Domestic Hot Water Outlet collar.
6. Remove the two fasteners at the DHW exchanger.

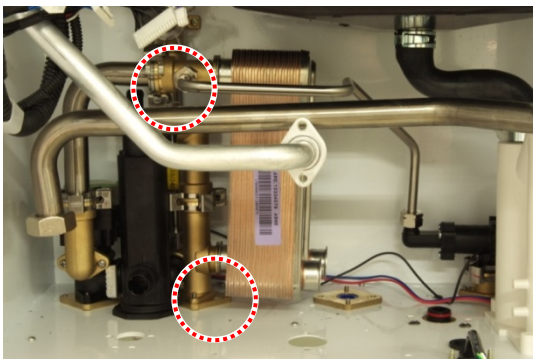


Figure 31

7. Replace with the new DHW Exchanger.

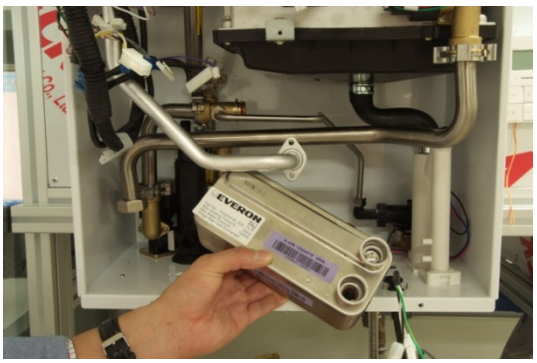
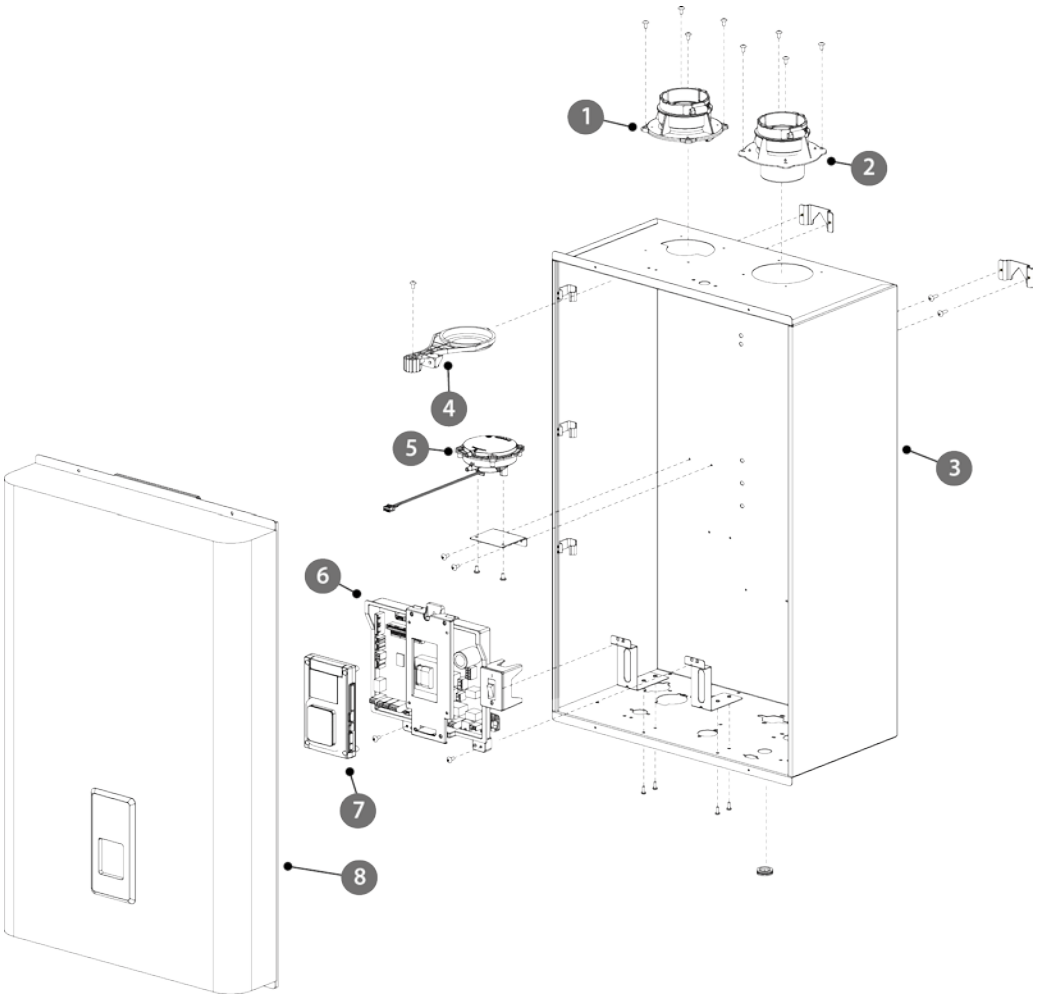


Figure 32

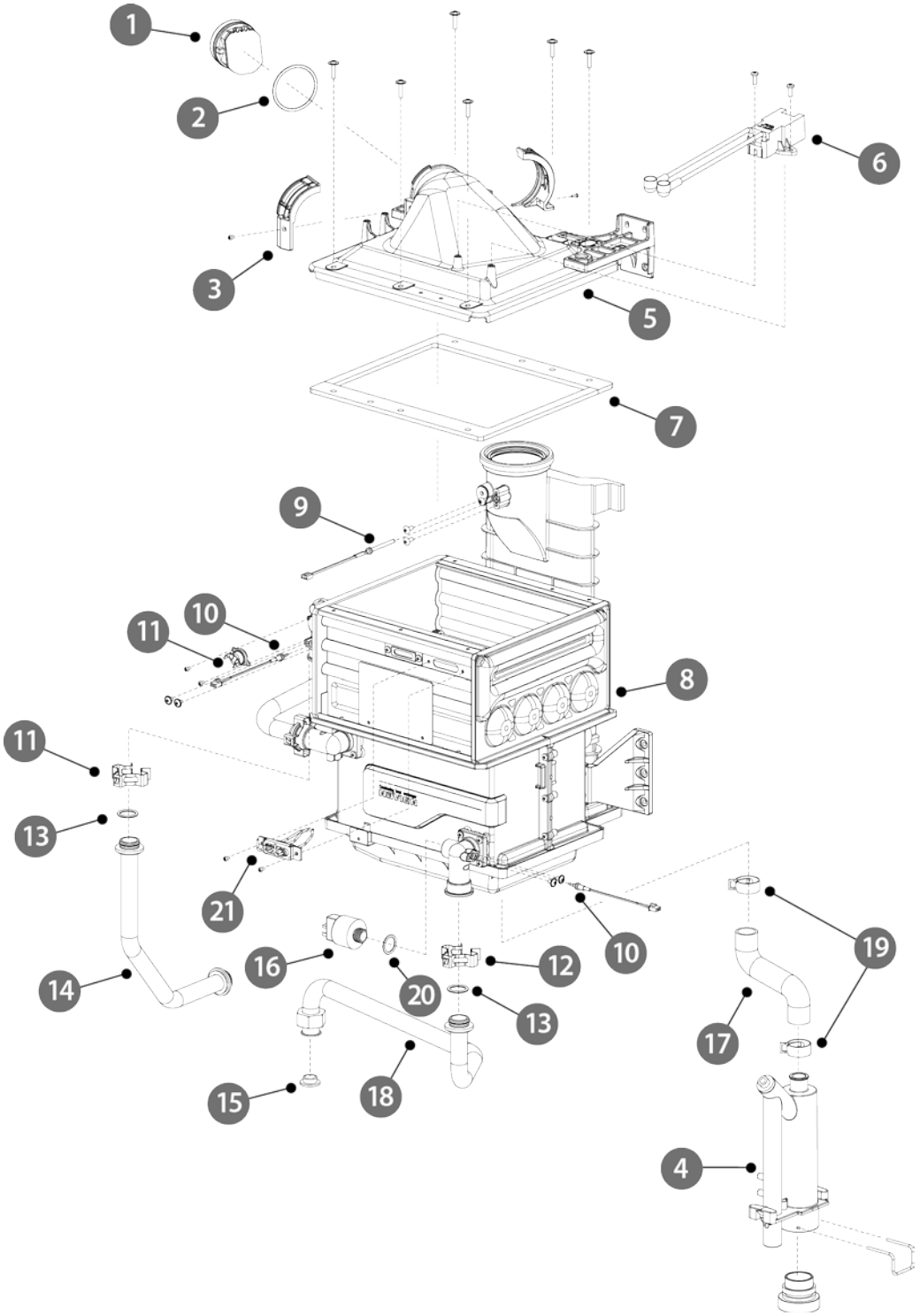
7. Components Diagram and Part List

7.1 Case Assembly



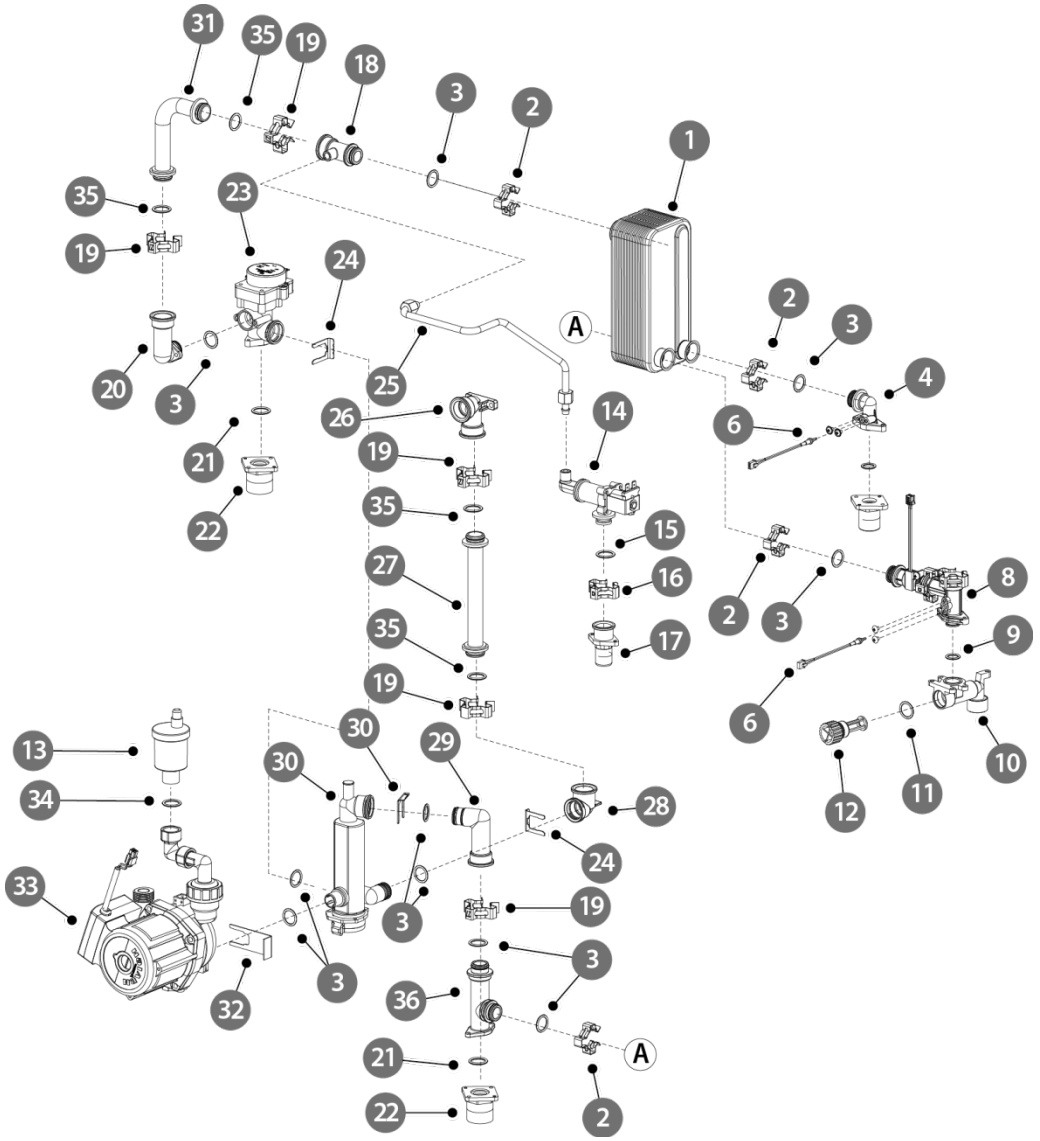
#	Description	Part #	Remark
1	Intake Air Duct Assembly	30008662B	
2	Exhaust Pipe Assembly	30008673A	
3	Case	20027375A	
4	Intake Air Filter	20007668A	
5	Air Pressure Sensor	30010346A	
6	PCB	30012262A	
7	Front Panel	30012269A	
8	Cover	30012276A	

7.2 Burner Assembly



#	Description	Part #	Remark
1	Damper	30008825A	
2	O-Ring (G50)	20003019A	
3	Fan Bracket	20022095A	
4	Siphon	30012280A	
5	Burner Chamber Ass'y	30010353A	NCB-180
		30008440A	NCB-210/240
6	Ignition Transformer	30010455A	
7	Burner Packing	20021677A	NCB-180
		20021672A	NCB-210/240
8	Heat Exchanger Ass'y	30012322A	NCB-180
		30012321A	NCB-210
		30012317A	NCB-240
9	Thermistor (Exhaust)	30009478A	
10	Thermistor (Water)	30008366A	
11	High Limit Switch	30002558A	
12	Fastener	20007859A	
13	O-Ring (P19)	20017211A	
14	Heat Exchanger Outlet Pipe	30011913A	NCB-180
		30011912A	NCB-210/240
15	Packing (Circulation Pump)	20027617A	
16	LWCO (Pressure Sensor)	20007924A	
17	Siphon Hose	20007853A	
18	Return Pipe	20018344A	
19	Siphon Fastener	30008366A	
20	LWCO Packing	20006873A	
21	Ignitor	30012226A	

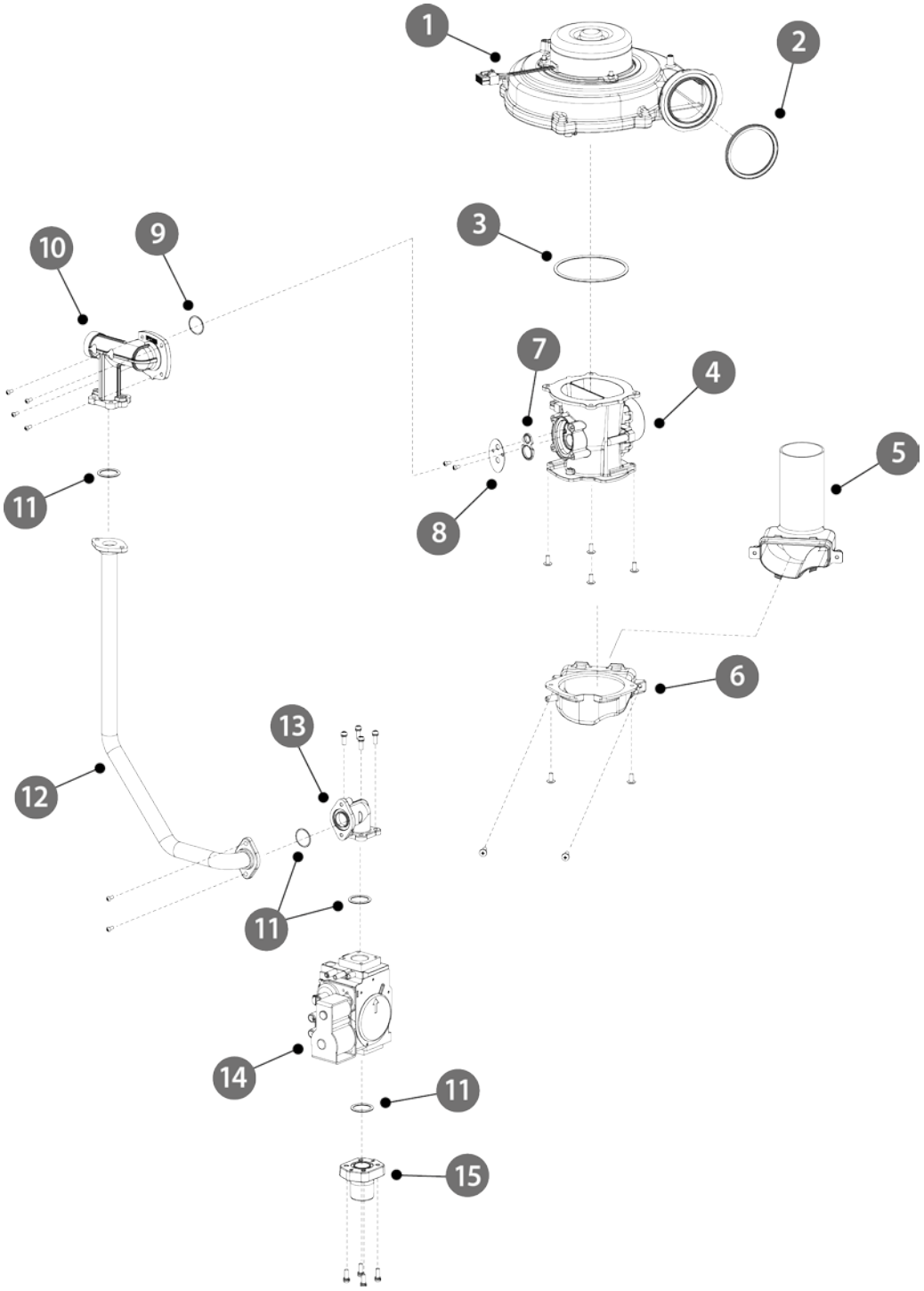
7.3 Waterway Assembly



#	Description	Part #	Remark
1	DHW Heat Exchanger	30008181A	NCB-180
		30005017A	NCB-210/240
2	Thermistor	30008366A	
3	O-Ring (P18)	20006954A	
4	DHW Outlet Elbow	30012328A	
5	Packing	20006852A	
6	Thermistor	30008366A	

#	Description	Part #	Remark
7	DHW Outlet Adpator	30003747A	
8	DHW Flow Sensor	30012033A	
9	O-Ring (P14)	20006952A	
10	DHW Cold Water Adaptor	30010317A	
11	O-Ring (P20)	20017212A	
12	DHW Cold Water Filter	-	
13	Air Vent	30012277A	
14	Auto Fill Valve	30012241A	
15	O-Ring (P16)	20011438A	
16	Fastener	20007859A	
17	Auto Fill Valve Adaptor	-	
18	3-Way Outlet Adaptor B	30012332A	
19	Fastener	20017726A	
20	3-Way Outlet Adaptor A	30012331A	
21	Packing	20011380A	
22	Connection Adaptor	20011408A	
23	3-Way Valve	30004816C	
24	Fastener	20007733A	
25	Water Fill Pipe	30012247A	
26	Space Heating Supply Adaptor A	20026931A	
27	Space Heating Supply Pipe	30011905A	
28	Space Heating Supply Adaptor B	20026930A	
29	Space Heating Return Adapter A	30012329A	
30	Space Heating Strainer	30002513D	
31	3-Way Outlet Pipe	30012328A	
32	Circulation Pump Fastener	20007877A	
33	Circulation Pump	30012177A	
34	Air Vent Packing	20014402A	
35	O-Ring (Φ18.8x2.6t)	20003022A	
36	Space Heating Return Adapter B	30012330A	

7.4 Fan (Gas) Assembly



#	Description	Part #	Remark
1	Fan Assembly	30008834A	
2	Fan Packing	20022744A	
3	O-Ring (G75)	20018079A	
4	Dual Venturi	30009219A	NCB-180
		30008909A	NCB-210/240
5	Silence	20019142A	NCB-180
		20023829A	NCB-210/240
6	Silence Adaptor	20023861A	NCB-180
		20019141A	NCB-210/240
7	Venturi Packing	20022660A	NCB-180
8	Gas Orifice	20024159A	NCB-180 (NG)
		20024190A	NCB-210/240 (NG)
		20019144A	NCB-180 (LP)
		20024189A	NCB-210/240 (LP)
9	O-Ring (P34)	20019090A	
10	Gas Adapter	30008431A	
11	O-Ring (P20)	20006934A	
12	Gas Pipe	30012338A	NCB-180
		30012058A	NCB-210/240
13	Gas Connector	20027149A	
14	Gas Valve	30011586A	NCB-180
		30008429A	NCB-210/240
15	Gas Inlet Adaptor	20007924A	20027748A

8. Inspection and Maintenance Schedule

8.1 Annual Servicing

In order to maintain its safe and efficient operation, it is recommended that the boiler is serviced annually.

> **CAUTION**
>
> Servicing must be performed by a qualified service agency or gas supplier

Inspection

- Visual inspection for general signs of corrosion
- Checking and adjusting the gas/air ratio
- Checking Flue Gas
- Carrying Out a Water Leak Test in Operation
- Carrying out a gas leak test in operation
- Checking Hot Water Temperature and Flow
- Checking Noise
- Checking venting systems
- Checking the remote controller

Maintenance

- Draining the boiler and cleaning the inlet water filter
- Cleaning the Return Filter
- Cleaning the intake air filter
- Flushing the heat exchanger
- Replacement of parts

8.2 Maintenance Report

Inspection Items	References	Date:	Date:
Draining the Boiler and Cleaning the Inlet Water Filter	YES / NO		
Cleaning the Return Filter	YES / NO		
Checking the Intake Air Filter	YES / NO		
Flushing the Heat Exchanger	YES / NO		
Replacement of Parts			

8.3 Maintenance Schedules

Owner maintance	
Daily	• Check boiler area • Check pressure / temperature gauge
Monthly	• Check vent piping • Check air piping (if installed) • Check air and vent termination screens • Check relief valve • Check condensate drain • Check air vents
Periodically	• Test low water cutoff (if used) • Reset button (low water cutoff)
Every 6 months	• Check boiler piping (gas and water) for leaks Operate relief valve
End of season months	• Shut boiler down (unless boiler used for domestic hot water)

8.4 Inspection Report

Inspection Items	References	Date:	Date:
Visual Inspection for General Signs of Corrosion	YES / NO		
Checking and Adjusting the Gas/Air Ratio	YES / NO		
Checking Flue Gas	YES / NO		
Carrying Out a Water Leak Test in Operation	YES / NO		
Carrying Out a Gas Leak Test in Operation	YES / NO		
Checking Hot Water Temperature and Flow	YES / NO		
Checking Noise	YES / NO		
Checking Venting Systems	YES / NO		
Checking the front panel.	YES / NO		

Memo

Memo

Memo

Memo

Memo

Memo

Memo

Memo